# SCS STUDY REPORT - VOLUME 2

## SPACE STATION
## SIMULATION COMPUTER SYSTEM (SCS) STUDY
## for
## NASA/MSFC

# CONCEPT DOCUMENT

MSFC-SPEC-1764

31 October, 1989

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Final Technical Report
Simulation Computer System for Space Station Program

In accordance with the requirements of the subject contract, the final technical report titled SCS Study Report, consisting of six volumes is herewith submitted and distributed as shown.

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# SPACE STATION SIMULATION COMPUTER SYSTEM (SCS) STUDY

# CONCEPT DOCUMENT

SCS SCS

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SCS SCS

CDRL: MSFC-SPEC-1764

31 October, 1989

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**Under:**

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## FORWARD

This SCS Concept Document is coded as follows:

1 - Words in the body of this document not in a box have been written by the SCS Study team.

2 - Words in the body of this document in a single box will be written by the SCS design/development contractor as part of the SCS design/development effort. The words there now are from the Space Station Freedom Program System Specification Data Item Description (DID) document and describe what should go in the section.

3 - Words in the body of this document in a single thick box will be filled in by NASA/MSFC to complete the document that results from the SCS Study. The words there now are from the DID and describe what should go in the section.

4 - *Words in the Venice FONT are suggestions made as part of the SCS study effort.*

# SCS CONCEPT DOCUMENT

## 1.0 INTRODUCTION

The Simulation Computer System SCS) Concept Document describes and establishes requirements for the functional performance of the SCS system, including interface, logistic, and qualification requirements.

The SCS is the computational, communications, and display segment of the MSFC Payload Training Complex PTC). The PTC is the MSFC facility that will train onboard and ground operations personnel to operate the payloads and experiments on board the international Space Station Freedom.

### 1.1 Identification

The SCS Concept Document is the root document identifying the requirements to be satisfied by the system implementation. This document is identified as the "Space Station Simulation Computer System (SCS)" Concept Document (NASA-MSFC-PTC/SCS-T3-0).

### 1.2 Scope

This Concept Document defines system operational and SCS user requirements that must be satisfied if the system is to meet its intended purpose.

The SCS includes all the computers, computer peripherals, networks, workstations, CBT stations, graphics hardware, and computer graphics generators. The SCS also includes the software needed to operate all the computer hardware and run the training simulation.

The PTC includes the trainer hardware - racks, US Lab control and display (C&D) panels, US Lab Element Control Workstations (ECWS), power supplies, wiring, cables, and the physical lab mockups ("cans"). The PTC also includes the testing phase simulation software to simulate payloads.

Also included in the PTC/SCS are GFE hardware and software needed to simulate onboard systems (Data Management System (DMS) Kits, ESA Kits, JEM Kits, ESA and JEM C&D Panels, and node Command and Control (C&C) stations). See Section 3.1.7 "Government-Furnished Property List " for details.

### 1.3 Purpose

The SCS Concept Document defines the requirements to be satisfied through the implementation of the system capability. The information contained within the document provides the operational basis for defining the requirements to be allocated to the system components and enables the system organization to assess whether or not the completed system complies with the requirements of the system.

## 1.4 Organization

The SCS Concept Document is a single document covering the SCS portion of the PTC/SCS. There is a separate requirements document that specifies the requirements for the PTC portion of the PTC/SCS system. These two documents are designed to specify the requirements, separately and with no overlap, for the total PTC/SCS system.

## 1.5 Objectives

The SCS Concept Document enables the Government to specify the requirements of the SCS system to potential system developers and provides an overview of the system for management, trainers, and support personnel.

## 2.0 APPLICABLE DOCUMENTS

This section lists additional, related documents.

### 2.1 Reference Documents

The following documents of the exact issue shown form a part of this document to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this document, the contents of this document shall be considered a superseding requirement.

#### 2.1.1 Specifications

2.1.1.1 Federal

None.

2.1.1.2 Military

None.

2.1.1.3 National Aeronautics and Space Administration

| Document No. | Title |
|---|---|
| JSC-30000 | Space Station Program Definition and Requirements Document |
| SSP 30261, Rev C | Architecture Control Document (ACD), Data Management System (DMS), 15 Dec '88. |
| TBD | SS Functional Control Document (FCD) for Training, 1 February '89. |

#### 2.1.2 Standards

2.1.1.1 Federal

| Document No. | Title |
|---|---|
| DOD-STD-100C | Engineering Drawing Practices |
| A.S.A X.35 | ANSI Flow Chart Symbols |

2.1.1.2 Military

| Document No. | Title |
|---|---|
| MIL-STD-1472C | Human Engineering Design Criteria for Military Systems, Equipment, and Facilities. |
| MIL-STD 454G | Standard General Requirements for Electrical Equipment. |

2.1.1.3 National Aeronautics and Space Administration

| Document No. | Title |
|---|---|
| MM8040 | MSFC Standard Contractor Configuration Management Requirements. |
| MSFC-MA-001-006-2H | MSFC Software Management and Development Requirements. |
| NHB 1700.1 | NASA Safety Manual (Systems Safety) |
| USE 1000 | SSIS Human-Computer Interface Guide, Version 2, 13 May '88. |
| LMSC F255493, DRL#93 | SSE Documentation Standards |
| DRAFT | PTC/SSTF Interface Requirements Document (IRD), 31 July, '89 |

### 2.1.3 Drawings

None.

### 2.1.4 Other Publications

| Document No. | Title |
|---|---|
| LMSC F255407,DRL#07 | SSE System Standards Document, 10 June, '88. |

Copies of specifications, standards, drawings, and publications required by suppliers in connection with specified procurement functions are to be obtained as directed by the contracting officer.

## 2.2 Information Documents

The following documents, although not a part of this document, amplify or clarify its contents.

| | |
|---|---|
| LMSC F255415, DRL#15 | SSE System Concept Document, 10 June, '88. |

| | |
|---|---|
| 0-917072-07-3 | Structured Analysis and System Specification, Yourdon Press, T. DeMarco, 1978. |
| NASA-Sfw-DID-00 | NASA Data Item Description System Specification, Version 3.0, Oct. 15, 1986. |
| TBD | Payload Training Methodology Study Report |
| JSC BRIEFING | Training Configurations, T.H. Kaiser, 1 Feb, '89. |
| TRW-SCS-89-T1 | SCS Study Issues Report, Sept. '89. |
| TRW-SCS-89-T2 | SCS Study Analysis Report, Sept '89 |
| TRW-SCS-89-T4-1 | SCS Conceptual Design Report, Sept '89. |
| TRW-SCS-89-T5 | SCS Detailed Conceptual Design Report, Sept '89 |
| TRW-SCS-89-T7 | SCS Final Report, Sept. '89. |

## 2.3 Parent Documentation

This section lists the parent document(s) that establish the criteria and technical basis for this document by document number, title and, if appropriate, release designator.

# 3.0 REQUIREMENTS

## 3.1 System Definition Requirements

The analysis phase of system development consists of studying a particular area or application for the purpose of producing an acceptable set of system requirements. Since the analysis phase usually addresses a large area of study, it is easier to seek methods which help one to break a large system down into more modules of manageable size. Related modules can be grouped together so that interfaces among modules are minimized and each module is reasonably independent of the others. This technique is known as functional partitioning or functional decomposition. Structured analysis is an orderly, rigorous approach to the software analysis phase that makes use of functional decomposition to help analysts produce system partitionings that are good in the sense that they lead to designs and implementations which are both implementable and maintainable. The structured analysis method utilizes the data flow diagram (DFD) as the fundamental tool for accomplishing a functional system decomposition. A complete set of DFDs depicts the entire system in terms of its processes and the data which flows between them. Data flow diagrams are made up of the following elements:

- Process -- a transformation of incoming data flows into outgoing data flows. Processes represent the functions of a system.

- Data Flow -- a conduit through which data of known composition flows. Data flows depict the interfaces among the system functions and the other DFD elements.

- Store -- a temporary repository of data. Stores represent data flow(s) frozen in time. Only the net flow of data into or out of the store is shown.

- Terminator -- a source from which data is received, or a sink to which data is transmitted, which are located outside the context of the system. Terminators represent external entities that send and receive system data. They are used only on context diagrams.

This section defines the SCS system definition requirements in terms of:

1. Purpose
2. Modes and States
3. Flow
4. Function/Requirements
5. Allocation

The following sections describe each in detail.

### 3.1.1 System Purpose

The main purpose of the PTC/SCS is to train the Space Station flight crews , POIC Cadre, PTC Personnel, and Science Operations Center Personnel to operate

the wide variety of experiments that will be onboard the Space Station Freedom. Training objectives for the PTC/SCS are shown in Figure 3-1.

The PTC/SCS interface to other Space Station elements is shown in Figure 3-2. All communication with these elements will be via the Space Station Information System (SSIS). Details of the information exchanges are given in the SCS context diagram (Figure 3-5) presented in section 3.1.3.

The PTC/SCS includes all the hardware and software specifically needed to provide realistic training for those who will operate space station payloads and experiments. Figure 3-3 shows a set of components that would meet the PTC/SCS requirements The components shown on Figure 3-3 are:

POIC Consoles - These are functionally, as well as cosmetically, equivalent to the actual consoles used in the POIC. The screen displays and interactions will be exactly like the operational consoles, but the actual hardware may be different. In the current baseline, these consoles will be part of and located in the POIC. There will be no separate set of consoles in the PTC/SCS.

Consolidated Increment Trainer - This consists of all three labs (US, Columbus , and JEM), connected together via the 2 connecting nodes. A logistics module is also included. It also includes the payload racks, power, lights, Data Management System (DMS) Kits or their international partner equivalents, and other hardware needed for realistic simulation of the entire laboratory portion of the SS.

Combined Trainer - This consists of individual, stand-alone labs (US, Columbus , and JEM), with a portable node and a portable logistics module. These also include the payload racks, power, lights, DMS Kits or their international partner equivalents, and other hardware needed for realistic simulation of the individual laboratories.

Attached Payload Trainer - This consists of the C&D panels, screens, and controls which make up the crew station for payloads that are attached on the truss outside the Labs. This crew station will be in one of the SSF nodes

Part-Task Trainers - Each of these consists of one to three payload racks and a console or workstation to control the simulation of individual payloads.

Computer Based Trainers (CBT) - These consist of stand-alone consoles or workstations for individual student training.

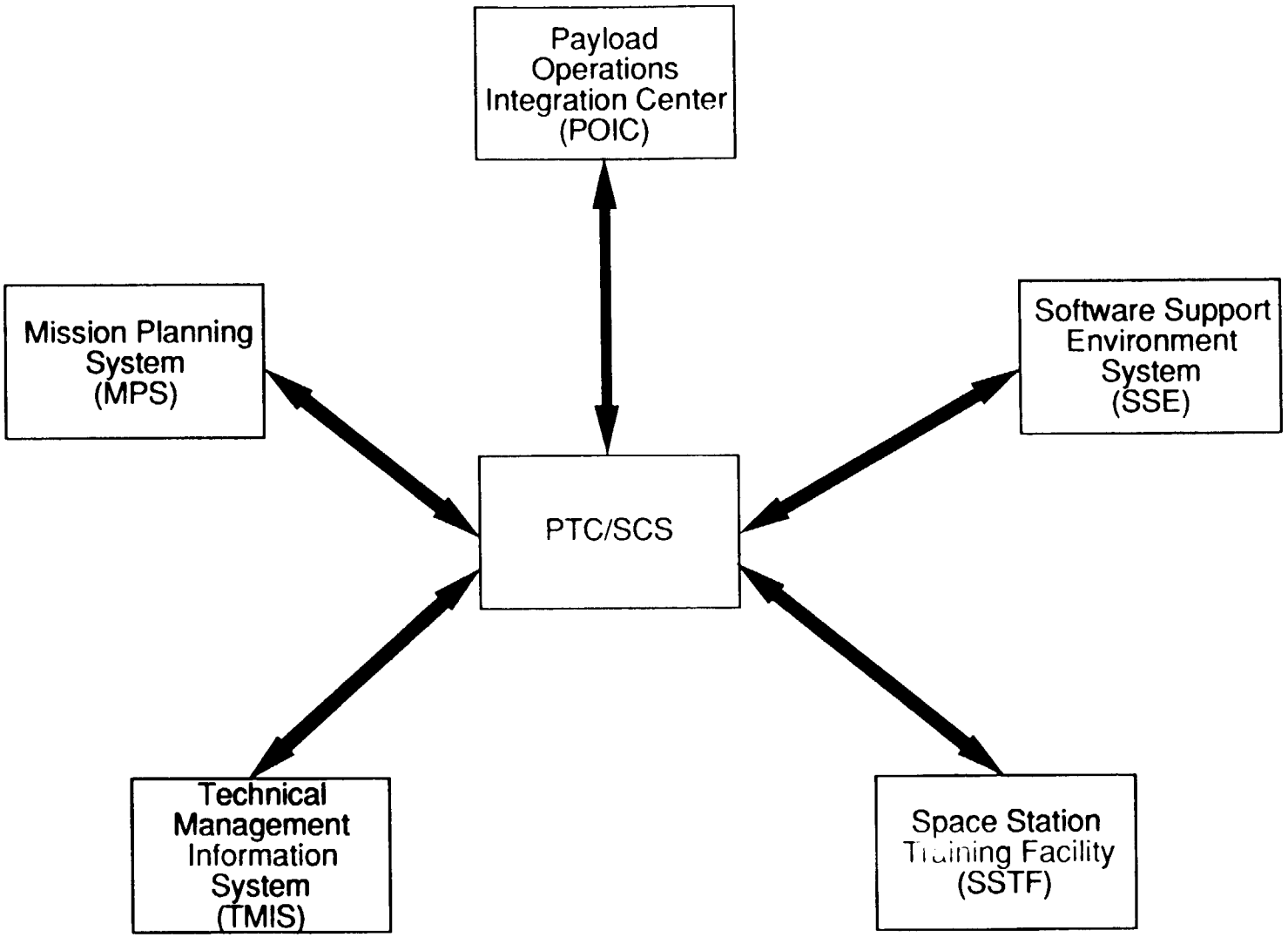
Simulator Development Facility - This consists of computers, software tools, and environments to aid in simulator development.

Integration, Test, and Verification Facility - This consists of all the hardware and services needed to support the PTC/SCS in integrating, testing, and verifying payload simulators.

| Training Type | Objective |
|---|---|
| Computer Based Training | Will train individual students utilizing scenarios without instructor intervention -- basic use will be to provide preliminary or introductory instruction via screen text, video, and graphics combined with questions to which the student would respond. |
| Part-Task Training | Primarily for developing single crewmember operating skills associated with individual payload flight operations. Will also be utilized for the development of ground support personnel operating skills associated with individual payload operations. |
| Combined Training | Primarily for training a team of 2 or more crewmembers to operate multiple payloads combined into specific labs. Supports the combination of crewmembers and ground support personnel for training on payload operations specific to a lab. |
| Consolidated Training | Primarily for training 4 or more crewmembers located in Freedom modules or the combination of crewmembers and ground support personnel for training on integrated payload operations throughout the entire manned base. |
| SSTF Integrated Training | Allows a student team to train on an entire mission increment at JSC with payload simulators running in a full-scale mode with the SSTF. |
| Consolidated Payload Simulation | Purpose is training crew at the PTC with teams of students at other operations centers, including the POIC and user operations centers (ROC's, DOC's, and UOF's) on specific flight increment objectives including reworking the short term plan, payload operations and updates, interactions with telescience operators, shift handovers, and payload malfunctions. |
| POIC Training | POIC Cadre members and certain representatives of remote operations centers can train on POIC systems, protocols and procedures using a representative subset of POIC components. |

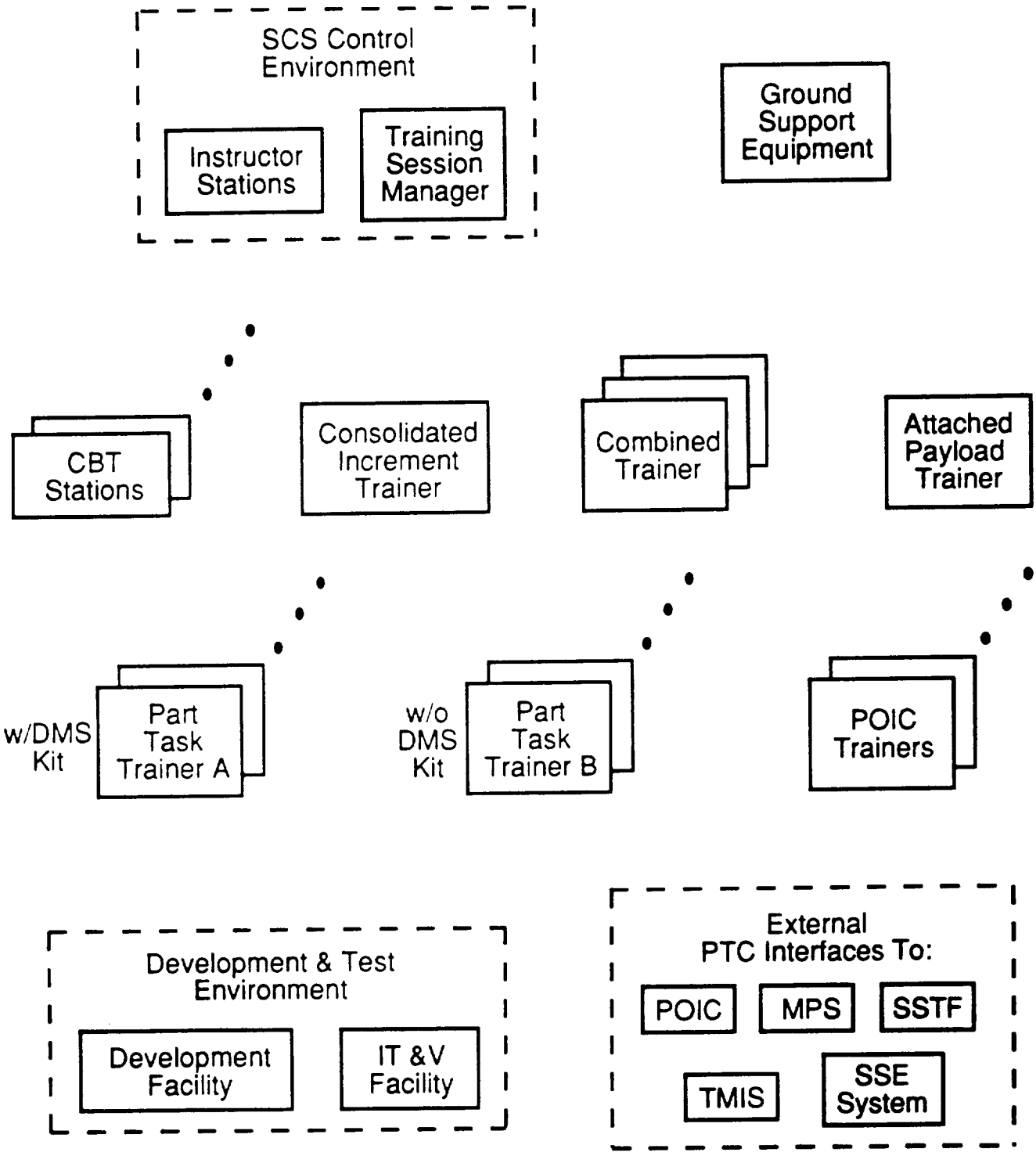
**PTC/SCS Training Objectives**

**Figure 3-1**




**PTC/SCS Interface to other SSFP Elements**

**Figure 3-2**




## PTC/SCS Components

**Figure 3-3**

External PTC Interfaces - These are the SCS components for communicating to the external elements as shown in Figure 3-1.

SCS Control Environment - This includes the instructor stations which the instructors use to control training, and the training session manager which will control the SCS configuration and prepare (initialize) the SCS to be operated.

Ground Support Equipment Subsystem - This consists of all the hardware and services needed to support PTC/SCS use of payload flight equivalent hardware such as facility power, facility heating and cooling, and facility audio/video.

The PTC consists of the hardware for the consolidated trainers (also called consolidated increment trainers) and combined trainers for the US Lab, the Japanese Experiment Module JEM), the European Space Agency (ESA) module, the attached payloads, and the part-task trainers. Consolidated increment and combined trainers are full scale, realistic physical trainers, much like the realistic trainers used to train aircraft pilots. Except for the lack of zero G, a person inside a PTC/SCS consolidated increment or combined trainer would see what an astronaut aboard the Space Station would see. Part-task trainers consist of a small subset of the full station module, and often consist of one to three racks of simulated experiments sitting next to an SCS workstation.

The SCS consists of the computer hardware, software, and workstations that will support the PTC in training people to operate and maintain the Space Station payloads.

To accomplish its purposes, the SCS must support the following major functions:

- Training
- Development.
- Operations Evaluation

### 3.1.1.1 Training

The SCS shall support training of:

a. The Payload Crew. This includes payload scientists, station scientists, and station operators as required.

b. The POIC Cadre. This is limited to training the cadre on payload specific commands, and does not include the training needed for POIC operation.

c. The PTC Personnel. These are the PTC instructors, developers, and operators. This training includes all training needed for them to operate the PTC/SCS.

### 3.1.1.2 Development

The SCS shall support development, which includes:

a. Support Functions . These include training planning and analysis, setup, CBT courseware development, and training results analysis.

b. Simulator Development. This includes requirements analysis, design, implementation, test, configuration management, and maintenance of SCS simulators which are software and/or hardware models.

c. Simulator Integration. This includes integrating internally developed simulators, integrating externally developed simulators, and integration into the operational PTC trainers. This also includes verification and validation of payload simulators.

### 3.1.1.3 Operations Evaluation

The SCS shall support operations evaluation, which includes:

a. Operations Concept definitions. Helping define, design, and refine the payload operations methods and concepts.

b. Crew and Operations Center procedures. Helping to define and refine the details of the procedures for both onboard and ground payload operations.

c. Timeline verification Using the PTC/SCS to aid in verifying the mission timeline.

d. Demonstrating and evaluating Space Station Technologies. Using the PTC/SCS to help evaluate the feasibility and improvements in payload operations that could be realized from introduction of new technologies onboard the SS.

### 3.1.2 System Modes And States

The SCS shall have three modes of operation.

1. Standard operations mode. This is the normal mode, and involves having the SCS support simultaneously all training, simulator development, and operations evaluation functions.

2. Trainee absent mode. This mode is the same as normal mode in that the SCS will support simultaneously all training, simulator development, and operations evaluation functions. The difference is that in this mode, in some of the sessions, the responses that normally come from the trainees at the C&D panels and MPACs will be generated by the computer in a repeating, unchanging sequence. This mode will be used for testing and some operations evaluations functions when exact repeatability is required. This

mode will also be used for stand-alone training (e.g. POIC) and testing where the C&D panel is some distance form the test console.

3. Preventative Maintenance (PM) mode. This mode will be used during normal PM, and it is planned that this will be performed on swing shift, separate from normal operations. It includes normal hardware PM and system data backups.

### 3.1.3 System Functional Flow Diagram

The SCS Functional Overview diagram (Figure 3-4) shows a comprehensive, hierarchial breakdown of all functions comprising the SCS. This diagram is meant to serve as an overall map to allow the reader to navigate the data flow diagrams. The functions shown at the same level on this diagram are at the same functional level. A portion of this drawing appears in the lower right-hand corner of each data flow diagram to help guide the reader.

The SCS Context diagram (Figure 3-5) is the top level SCS System Functional Flow Diagram. The context diagram graphically delineates the functional boundary (the domain) of the system under study, and the external environment. The data flows on the context diagram depict the communication of data between the system and its external sources and receivers of data. This illustrates the major data flow in all functional states (on a top level diagram, not all states are individually represented). The circle in the center of the diagram represents the SCS system, and the boxes represent entities external to the SCS system. The following list is a definitive explanation of each external entity:

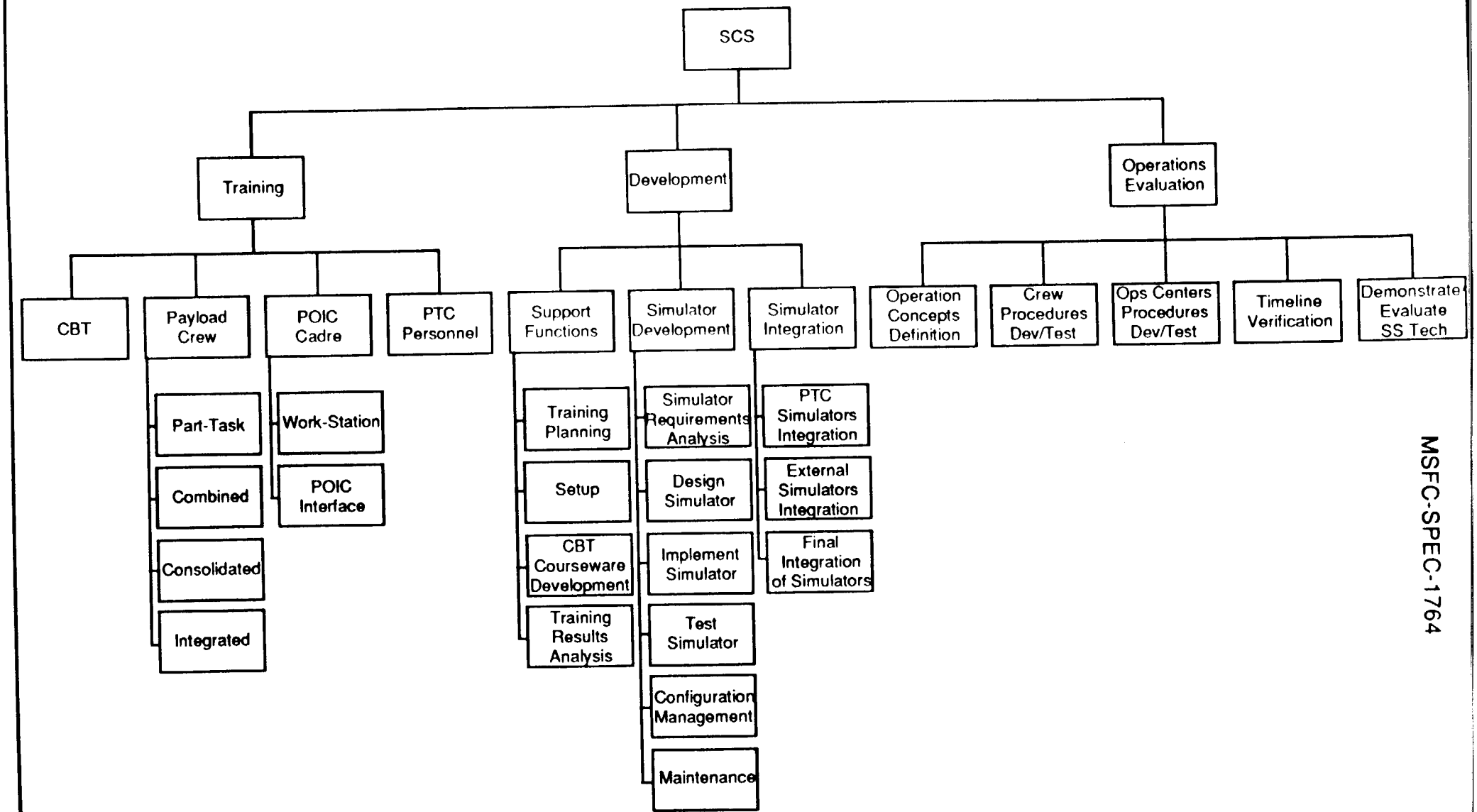
• MPS-Mission_Planning_System -- represents the MSFC operations that will provide all the information needed to most efficiently operate the payload missions. This information includes such things as timelines, orbital ephemerides, and SSF orientation data.

• PD-Payload_Developers box represents developers who do not use the SCS to develop payload simulators, e.g. PIs who develop simulators at their sites.

• PFE-PTC_Facility_Equipment -- represents PTC equipment which are not direct training devices, specifically Ground Support Equipment (GSE) and audio/video systems such as facility VCRs and cameras.

• POIC-POIC -- represents the Payload Operations Integration Center that will interface with the SCS to send and receive payload downlink and uplink data for payload crew and POIC cadre training.

• PTD-PTC_Training_Devices -- represents the hardware (control and display panels and crew workstations) in the consolidated increment and combined trainers and part-task trainers that simulates the real onboard payload operations hardware. This simulated hardware is where the students will interface with the SCS to receive their high fidelity payload operations training.




**SCS Functional Overview**

**Figure 3-4**

• SSE-SSE_System -- represents the Software Support Environment System that will provide all tools, rules, and procedures for the SCS and will also provide system simulations, flight software, and configuration management status information. The SCS will send the SSE simulations any necessary configuration management information.

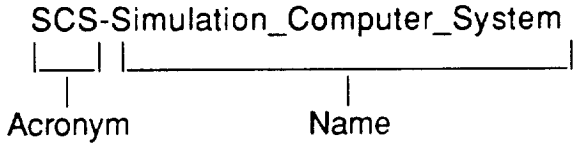
• SSTF-SSTF -- represents the Space Station Training Facility at Johnson Space Center. The SCS will be required to support integrated mode with the SSTF in full integrated mode on-site at JSC.

• TMIS-TMIS -- represents the Technical Management Information System that will provide the SCS with program schedule information and will store student records and results.

• USER-SCS_Users -- represents the instructors, developers, and operators, i.e. all the people who will use the PTC to provide training for the students.

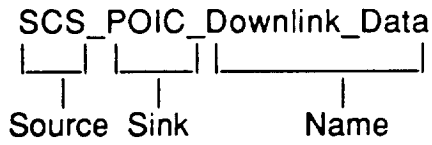
The following syntax applies to all data flow diagrams:

a. Each process bubble, external entity, and data store have a prefix, which is its acronym, followed by a hyphen and then its name. For example, the process bubble "Simulation_Computer_System" is denoted by




The acronyms serve as aids in data flow directions. (see No. 2)

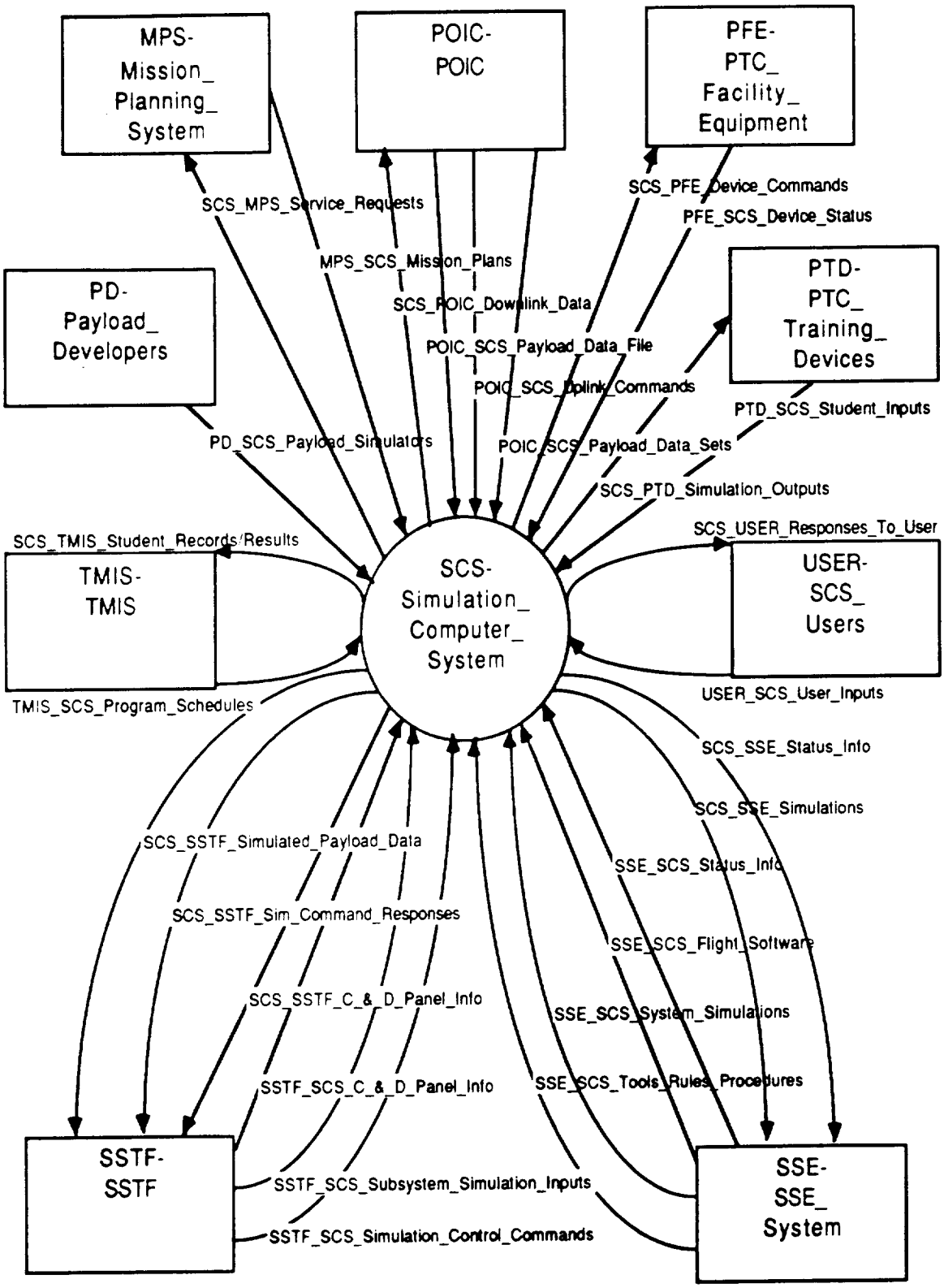
b. Each data flow has two acronyms attached as a prefix. The first acronym is the source of the data flow and the second acronym is the sink of the data flow. For example, the data flow "Downlink_Data" that flows from the "SCS-Simulation_Computer_System" to the "POIC-POIC" would be written as follows:




This technique is to aid the reader of the diagram, especially when multiple data flows on a page make it difficult to determine where data is coming from and going to.

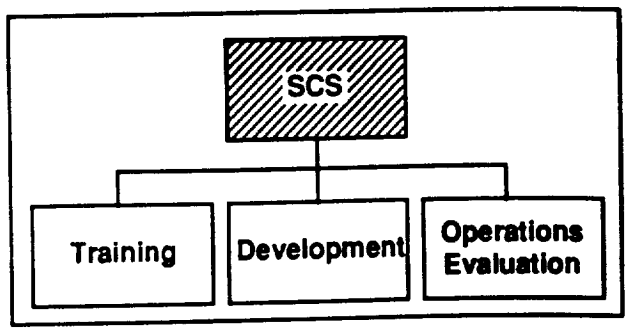
Note: If two or more data flows have the same name except for the acronyms attached to the front of it, then they are one and the same. Example:

SCS_POIC_Downlink_Data = TRA_POIC_Downlink_Data




**SCS Context Diagram**

**Figure 3-5**



All data flow acronyms are listed in Appendix I, and the Data Dictionary. (see Appendix II) defines all data flow entries. The data dictionary provides a central repository for the definitions of data flows, data elements (components of data flows) and stores. Top-down partitioning of the data in a given set of data flow diagrams is facilitated by defining complex data flows in terms of other, subordinate data flows. Due to the naming convention of the data flows, the data dictionary may define one data flow as being the same name except for the difference in acronyms. The lowest level of a data flow will contain a definition as opposed to being defined in terms of other data flows.

### 3.1.4 System Functions

Figure 3-6 DF/0 shows the three main SCS functions and the associated data flows and data stores. The three main functions are as follows:

1. Training
2. Development
3. Operations Evaluations

#### 3.1.4.1 Training Functions

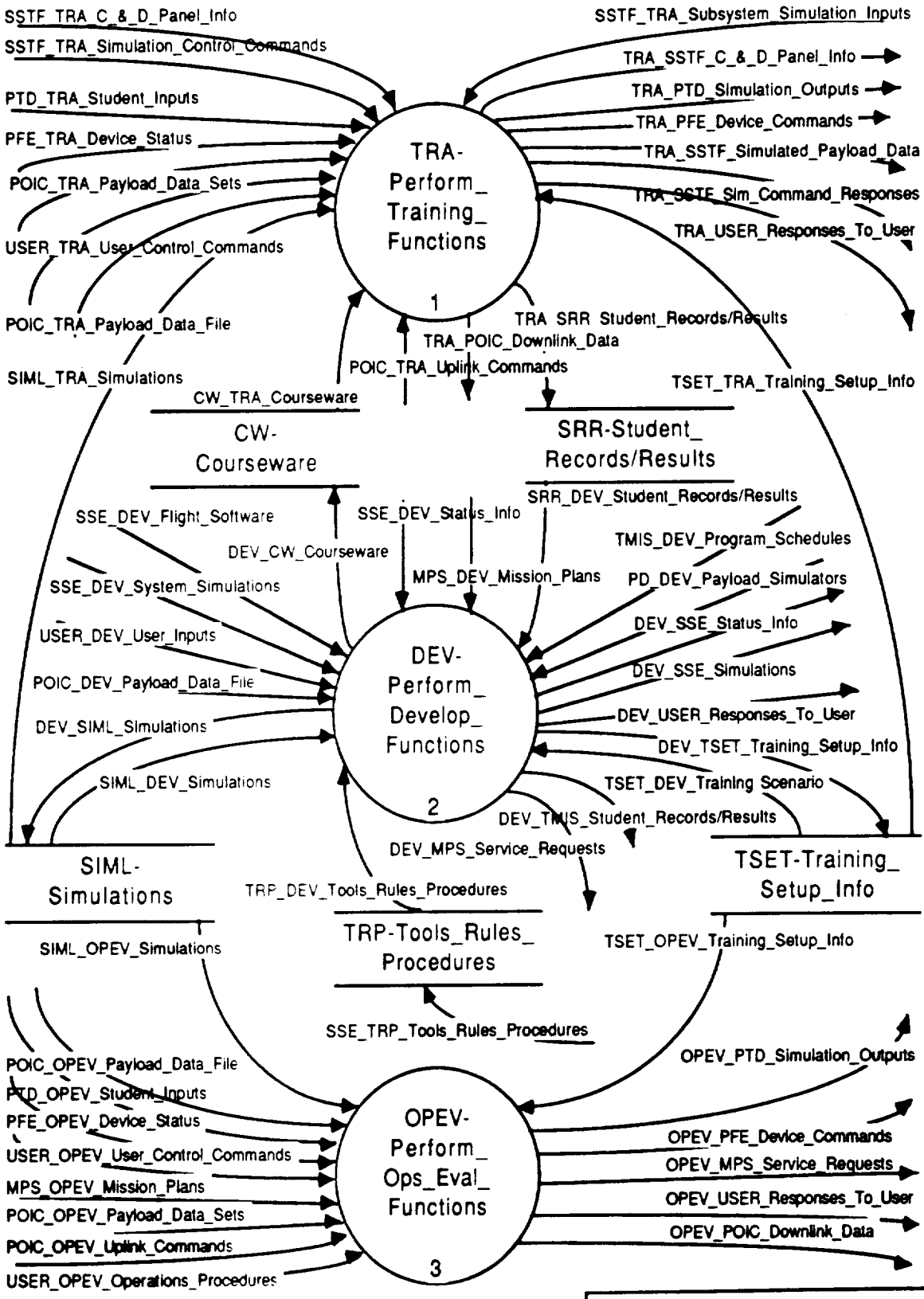
Figure 3-7 DF/1 shows the SCS training functions and the associated data flows. The training functions are as follows:

1. Computer Based Training
2. Payload Crew Training
3. POIC Cadre Training
4. PTC Personnel Training

##### 3.1.4.1.1 Computer Based Training

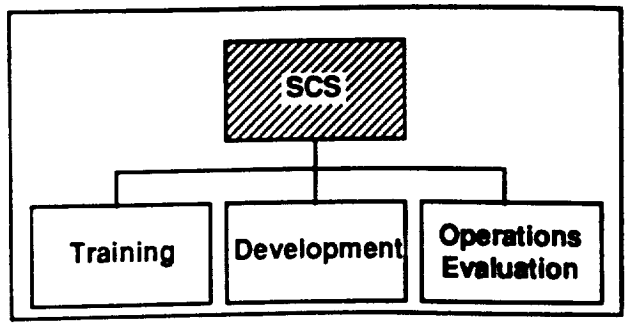
The Computer Based Training function will allow the student to train on a payload increment via screen without instructor assistance. This training will consist of overall increment lesson summaries and actual training scenarios for the payload crew, POIC cadre, and PTC personnel. All training accomplished during these sessions will provide immediate feedback to the student, thus allowing the student the opportunity to correct his mistakes before training becomes more involved with part-task training, combined training, consolidated training, and integrated training. Computer Based Training provides an excellent alternative to prepare the student for the overall payload mission increment.

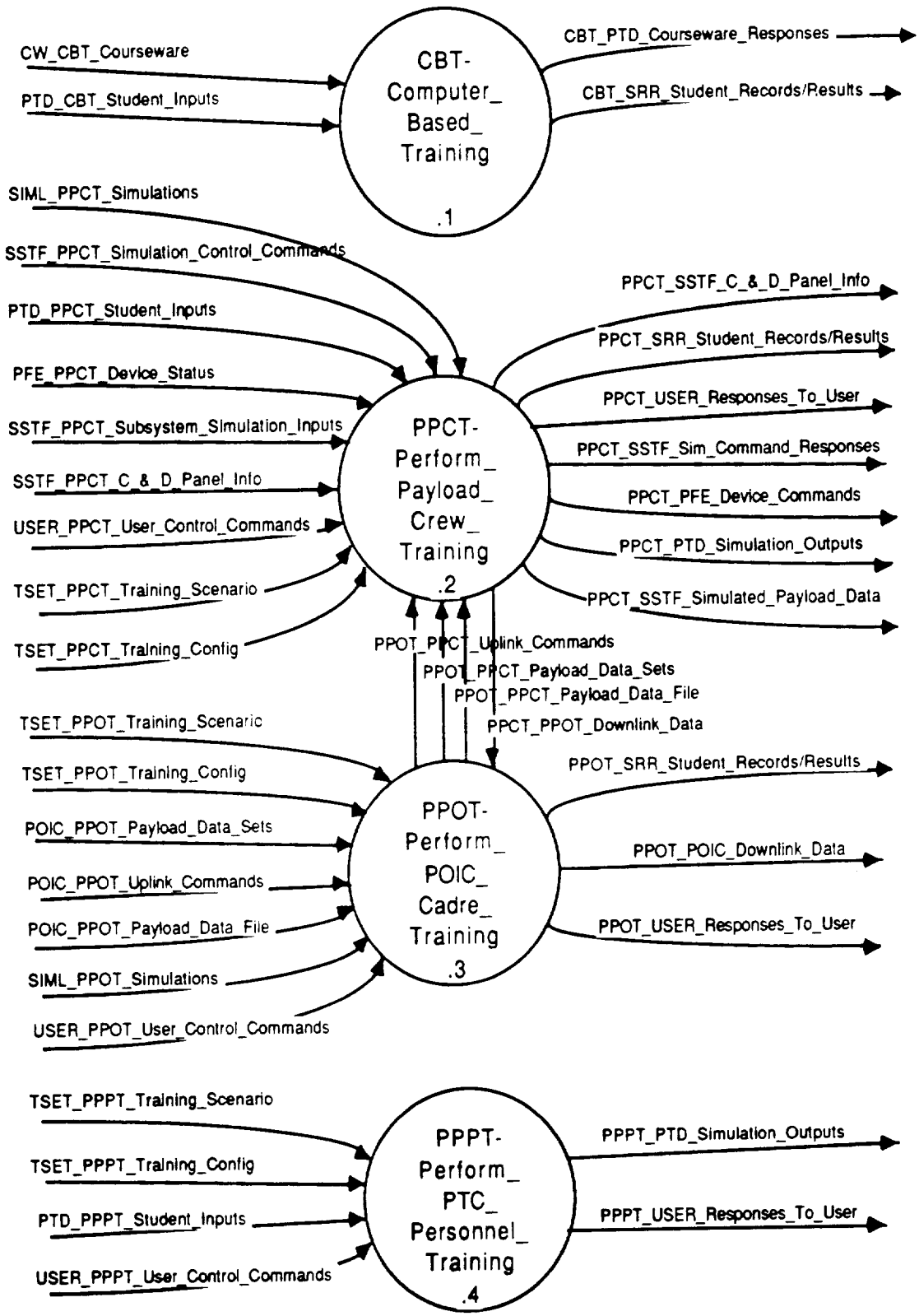
Inputs
a. PTD_CBT_Student_Inputs
b. CW_CBT_Courseware




**DF/0 Simulation Computer System**

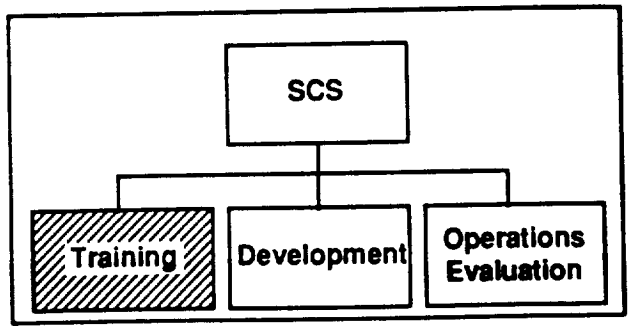
**Figure 3-6**






**DF/1 Perform Training Functions**

**Figure 3-7**



Outputs
a. CBT_PTD_Courseware_Responses
b. CBT_SRR_Student_Records/Results
c. CBT_PTR_PTC_Training_Results

3.1.4.1.1.1 The Computer Based Training function shall provide a training tutorial session for all student types.

3.1.4.1.1.2 The Computer Based Training function shall provide capability for interactive activation/detection of student inputs/responses.

3.1.4.1.1.3 The Computer Based Training function shall provide the capability for the automatic collection of detailed performance data from the student inputs/responses.

3.1.4.1.1.4 The Computer Based Training function shall provide the capability of analyzing student inputs/responses.

3.1.4.1.1.5 The Computer Based Training function shall provide the capability for menu-driven, windows, and/or icon instructional training in order to meet the dynamic needs of the student.

3.1.4.1.1.6 The Computer Based Training function shall provide the capability for defaults on training options to minimize the necessity for manual entry.

3.1.4.1.1.7 The Computer Based Training function shall provide the capability for instructional lesson summaries that will correlate training material for related operational increments.

3.1.4.1.1.8 The Computer Based Training function shall provide the capability to select different training scenarios for any given increment and user type.

3.1.4.1.1.9 The Computer Based Training function shall provide the capability to repeat any selected training scenario.

3.1.4.1.1.10 The Computer Based Training function shall provide the capability to follow various instructional paths based upon student responses.

3.1.4.1.1.11 The Computer Based Training function shall provide the capability for immediate student feedback.

3.1.4.1.1.12 The Computer Based Training function shall provide the capability to represent the basic USE capabilities as defined within the SSE.

3.1.4.1.1.13 The Computer Based Training function shall provide the capability to allow for selection of three expertise levels of training scenarios which include novice, nominal, and expert.

3.1.4.1.1.14 The Computer Based Training function shall provide the capability to simultaneously accommodate TBD flight crew teams consisting of 4-6 students per team.

3.1.4.1.1.15 The Computer Based Training function shall provide the capability to simultaneously accommodate TBD POIC cadre teams consisting of TBD students per team.

3.1.4.1.1.16 The Computer Based Training function shall provide the capability to simultaneously accommodate TBD PTC personnel teams consisting of TBD students per team.

3.1.4.1.1.17 The Computer Based Training function shall provide the capability for high quality graphics equivalent to the Space Station Multi-purpose Application Console (MPAC).

3.1.4.1.1.18 The Computer Based Training function shall provide the capability for audio equivalent to the Space Station Multi-purpose Application Console (MPAC).

3.1.4.1.1.19 The Computer Based Training function shall provide the capability for video equivalent to the Space Station Multi-purpose Application Console (MPAC).

3.1.4.1.1.20 The Computer Based Training function shall provide the capability for video interaction utilizing a video disk system.

### 3.1.4.1.2 Payload Crew Training

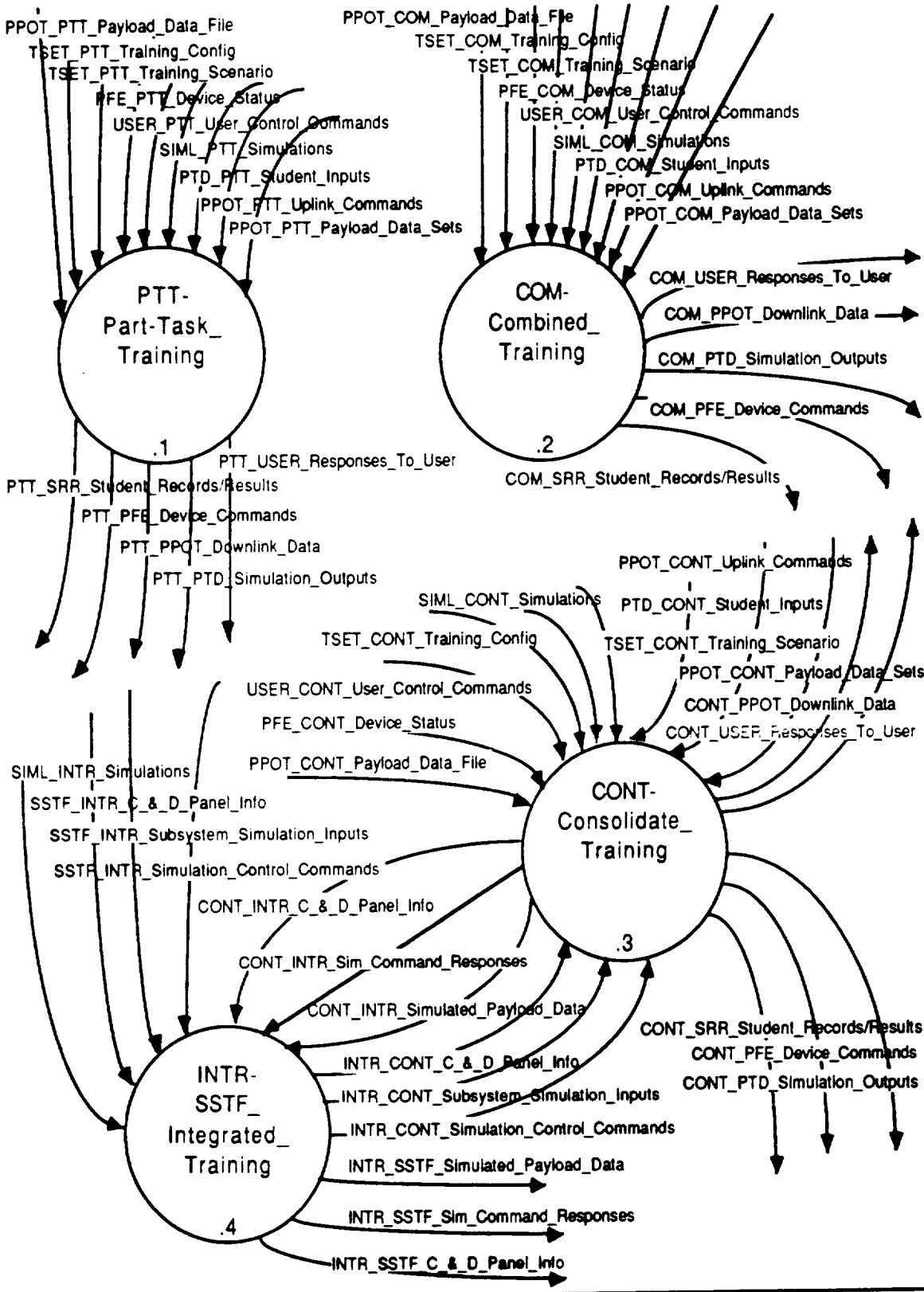
Figure 3-8 DF/1.2 shows the SCS payload crew training functions and the associated data flows. The payload crew training functions are as follows:

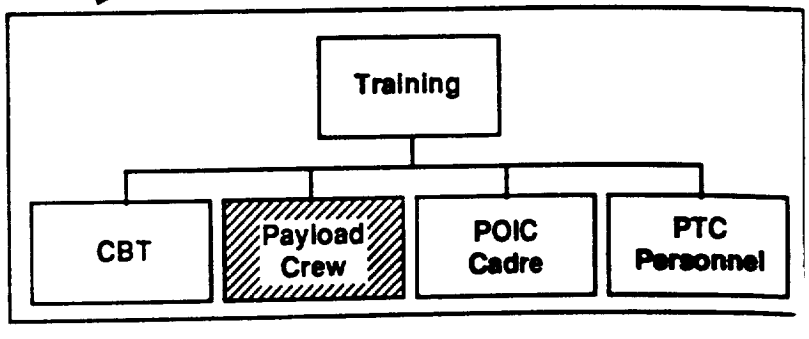
1. Part-Task/Combined Training
2. Consolidated Training
3. SSTF Integrated Training

#### 3.1.4.1.2.1 Part-Task Training

The Part-Task Training function will allow the payload crew student to train on an individual payload experiment currently in the PTC training flow. Training will be provided for nominal and contingency operations and will operate at the fidelity necessary to fulfill training requirements. This training will consist of one to three racks of simulated experiments from any Space Station Freedom module.

Inputs
a. PFE_PTT_Device_Status
b. USER_PTT_User_Control_Commands
c. SIML_PTT_Simulations
d. PTD_PTT_Student_Inputs




**DF/1.2 Perform Payload Crew Training**

**Figure 3-8**

e. PPOT_PTT_Uplink_Commands
f. PPOT_PTT_Payload_Data_Sets
g. TSET_PTT_Training_Scenario
h. TSET_PTT_Training_Config
i. PPOT_PTT_Payload_Data_File

Outputs
a. PTT_USER_Responses_To_User
b. PTT_PTD_Simulation_Outputs
c. PTT_PFE_Device_Commands
d. PTT_SRR_Student_Records/Results
e. PTT_PPOT_Downlink_Data

3.1.4.1.2.1.1 The Part-Task Training function shall support training for individual payload experiments currently in the PTC training flow.

3.1.4.1.2.1.2 The Part-Task Training function shall provide the capability to reconfigure within 4 days from one increment to another during a training period.

3.1.4.1.2.1.3 The Part-Task Training function shall provide the capability for hardware and software rack reconfiguration.

3.1.4.1.2.1.4 The Part-Task Training function shall provide experiment training in nominal and contingency operations for flight and personnel.

3.1.4.1.2.1.5 The Part-Task Training function shall provide the capability to support up to 9 independent simultaneous training sessions, with each session consisting or utilizing up to 3 racks.

3.1.4.1.2.1.6 The Part-Task Training function shall provide the capability to simulate flight audio control interfaces and control PTC representations of audio components internal to the U.S. Lab, Columbus, and JEM modules for individual payload experiments.

3.1.4.1.2.1.7 The Part-Task Training function shall provide the capability to simulate flight video control interfaces of the U.S. Lab, Columbus, JEM modules and attached payloads for individual payload experiments.

3.1.4.1.2.1.8 The Part-Task Training function shall provide the capability to create, control, and manipulate payload video images.

3.1.4.1.2.1.9 The Part-Task Training function shall provide a standard interface for payload simulator manipulation of video images.

3.1.4.1.2.1.10 The Part-Task Training function shall provide the capability to control PTC video components of the U.S. Lab, Columbus, JEM modules, and attached payloads.

3.1.4.1.2.1.11 The Part-Task Training function shall provide the capability to control the PTC audio and video support networks.

3.1.4.1.2.1.12 The Part-Task Training function shall provide the capability to support 2 flight crew teams consisting of 4-6 students per team.

3.1.4.1.2.1.13 The Part-Task Training function shall provide TBD number of virtual control panel simulators.

3.1.4.1.2.1.14 The Part-Task Training function shall provide the capability to train concurrently and simultaneously with the increment currently being trained on and the following increment.

3.1.4.1.2.1.15 The Part-Task Training function shall provide the capability to support individual payload experiment training in an independent, stand-alone mode.

3.1.4.1.2.1.16 The Part-Task Training function shall provide the capability to interface with the Data Management System (DMS) kits.

3.1.4.1.2.1.17 The Part-Task Training function shall provide a standard malfunction control interface to instructors or automated scripts.

3.1.4.1.2.1.18 The Part-Task Training function shall provide the capability for automated initialization based on the simulation configuration.

3.1.4.1.2.1.19 The Part-Task Training function shall provide a standard interface for experiment control and display panels.

3.1.4.1.2.1.20 The Part-Task Training function shall receive and process uplink command inputs from the Perform POIC Cadre Training function.

3.1.4.1.2.1.21 The Part-Task Training function shall provide the capability to generate and transfer downlink data to the Perform POIC Cadre Training function.

3.1.4.1.2.1.22 The Part-Task Training function shall provide the capability for training simulators to be portable between part-task trainers, combined trainers, and consolidated trainers without modification.

3.1.4.1.2.1.23 The Part-Task Training function shall provide the capability to execute flight CUI software and emulate CUI capabilities.

3.1.4.1.2.1.24 The Part-Task Training function shall provide the capability for an emulation of flight software.

3.1.4.1.2.1.25 The Part-Task Training function shall provide the appropriate data interfaces for the operation of real/prototype payload hardware in the training environment.

3.1.4.1.2.1.26 The Part-Task Training function shall provide control and monitor interfaces for support equipment required to operate real/prototype payload hardware in the training environment.

3.1.4.1.2.1.27 The Part-Task Training function shall provide the capability to execute actual payload flight software designed for execution in DMS processors (SDP, MDM/EDP).

3.1.4.1.2.1.28 The Part-Task Training function shall provide a standard control and monitor interface for payload unique (non-DMS processors) and support equipment utilized in a training environment.

3.1.4.1.2.1.29 The Part-Task Training function shall provide the capability to execute payload simulators at frequencies sufficient to support data acquisition of flight software.

3.1.4.1.2.1.30 The Part-Task Training function shall provide the capability execute different simulators at various fidelities.

3.1.4.1.2.1.31 The Part-Task Training function shall provide the capability to execute payload simulators at rates required to duplicate flight system payload data display and downlink characteristics.

3.1.4.1.2.1.32 The Part-Task Training function shall provide capabilities and standard interfaces to control simulation modes including run, stop, step-ahead, checkpoint, and restart.

3.1.4.1.2.1.33 The Part-Task Training function shall provide the capability for standard payload simulator run-time interfaces to subsystem, environmental, and payload support simulations as defined by SSF simulation standards.

3.1.4.1.2.1.34 The Part-Task Training function shall provide the capability to control the training session through execution of training scripts.

3.1.4.1.2.1.35 The Part-Task Training function shall provide the capability for rule-based evaluation of training results in real-time.

3.1.4.1.2.1.36 The Part-Task Training function shall provide the capability to log training results to storage under user or script control.

3.1.4.1.2.1.37 The Part-Task Training function shall provide the capability to automatically modify training scripts and scenarios based upon student responses.

3.1.4.1.2.1.38 The Part-Task Training function shall provide simulations of natural and induced space environment affecting the Space Station.

3.1.4.1.2.1.39 The Part-Task Training function shall provide a simulation of ground commanding capabilities.

3.1.4.1.2.1.40 The Part-Task Training function shall provide the capability to collect simulation execution metrics.

3.1.4.1.2.1.41 The Part-Task Training function shall provide the capability to generate responses that normally come from the trainee in order to do testing and operations evaluation functions.

3.1.4.1.2.1.42 The Part-Task Training function shall provide the capability for PIs to connect to the SCS from a remote location (i.e., UOF, DOC, ROC) anywhere in the world for the purpose of developing crew procedures. The PI would need an MPAC or equivalent at his/her lab to communicate with the payload simulation running at the SCS in the trainee absent mode.

### 3.1.4.1.2.2 Combined Training

The Combined Training function will allow the payload crew student to train on a selected group of payload experiments currently in the PTC training flow. Training will be provided for nominal and contingency operations and will operate at the fidelity necessary to fulfill training requirements. This training will consist of multiple or all experiments from either the U.S. Lab, Columbus, or JEM payloads for a given increment with payload support systems and multiple payloads in joint operation.

Inputs
a. PPOT_COM_Payload_Data_File
b. TSET_COM_Training_Config
c. TSET_COM_Training_Scenario
d. PFE_COM_Device_Status
e. USER_COM_User_Control_Commands
f. SIML_COM_Simulations
g. PTD_COM_Student_Inputs
h. PPOT_COM_Uplink_Commands
i. PPOT_COM_Payload_Data_Sets

Outputs
a. COM_USER_Responses_To_User
b. COM_PPOT_Downlink_Data
c. COM_PTD_Simulation_Outputs
d. COM_PFE_Device_Commands
e. COM_SRR_Student_Records/Results

3.1.4.1.2.2.1 The Combined Training function shall support training for selected groups of payload experiments currently in the PTC training flow.

3.1.4.1.2.2.2 The Combined Training function shall provide the capability to reconfigure within 7 days from one increment to another during a training period.

3.1.4.1.2.2.3 The Combined Training function shall provide the capability for hardware and software rack reconfiguration.

3.1.4.1.2.2.4 The Combined Training function shall provide experiment training in nominal and contingency operations for flight and ground personnel.

3.1.4.1.2.2.5 The Combined Training function shall provide the capability to simulate flight audio control interfaces and control PTC representations of audio components internal to the U.S. Lab, Columbus, and JEM modules for selected groups of payload experiments.

3.1.4.1.2.2.6 The Combined Training function shall provide the capability to simulate flight video control interfaces of the U.S. Lab, Columbus, JEM modules and attached payloads for selected groups of payload experiments.

3.1.4.1.2.2.7 The Combined Training function shall provide the capability to create, control, and manipulate payload video images.

3.1.4.1.2.2.8 The Combined Training function shall provide a standard interface for payload simulator manipulation of video images.

3.1.4.1.2.2.9 The Combined Training function shall provide the capability to control PTC video components of the U.S. Lab, Columbus, JEM modules, and attached payloads.

3.1.4.1.2.2.10 The Combined Training function shall provide the capability to control the PTC audio and video support networks.

3.1.4.1.2.2.11 The Combined Training function shall provide the capability to support 2 flight crew teams consisting of 4-6 students per team.

3.1.4.1.2.2.12 The Combined Training function shall provide TBD number of virtual control panel simulators.

3.1.4.1.2.2.13 The Combined Training function shall provide the capability to train concurrently and simultaneously with the increment currently being trained on and the following increment.

3.1.4.1.2.2.14 The Combined Training function shall provide the capability to interface with the Data Management System (DMS) kits.

3.1.4.1.2.2.15 The Combined Training function shall provide a standard malfunction control interface to instructors or automated scripts.

3.1.4.1.2.2.16 The Combined Training function shall provide the capability for automated initialization based on the simulation configuration.

3.1.4.1.2.2.17 The Combined Training function shall provide a standard interface for experiment control and display panels.

3.1.4.1.2.2.18 The Combined Training function shall receive and process uplink command inputs from the Perform POIC Cadre Training function.

3.1.4.1.2.2.19 The Combined Training function shall provide the capability to generate and transfer downlink data to the Perform POIC Cadre Training function.

3.1.4.1.2.2.20 The Combined Training function shall provide the capability for training simulators to be portable between part-task trainers, combined trainers, and consolidated trainers without modification.

3.1.4.1.2.2.21 The Combined Training function shall provide the capability to execute flight CUI software and emulate CUI capabilities.

3.1.4.1.2.2.22 The Combined Training function shall provide the capability for an emulation of flight software.

3.1.4.1.2.2.23 The Combined Training function shall provide the capability to concurrently operate all training simulators for the U.S. Lab configuration.

3.1.4.1.2.2.24 The Combined Training function shall provide the capability to concurrently operate all training simulators for the Columbus configuration.

3.1.4.1.2.2.25 The Combined Training function shall provide the capability to concurrently operate all training simulators for the JEM configuration.

3.1.4.1.2.2.26 The Combined Training function shall provide the capability to concurrently operate all training simulators for the attached payloads configuration.

3.1.4.1.2.2.27 The Combined Training function shall provide the appropriate data interfaces for the operation of real/prototype payload hardware in the training environment.

3.1.4.1.2.2.28 The Combined Training function shall provide control and monitor interfaces for support equipment required to operate real/prototype payload hardware in the training environment.

3.1.4.1.2.2.29 The Combined Training function shall provide the capability to execute actual payload flight software designed for execution in DMS processors (SDP, MDM/EDP).

3.1.4.1.2.2.30 The Combined Training function shall provide a standard control and monitor interface for payload unique (non-DMS processors) and support equipment utilized in a training environment.

3.1.4.1.2.2.31 The Combined Training function shall provide the capability to execute payload simulators at frequencies sufficient to support data acquisition of flight software.

3.1.4.1.2.2.32 The Combined Training function shall provide the capability to execute different simulators at various fidelities.

3.1.4.1.2.2.33 The Combined Training function shall provide the capability to execute payload simulators at rates required to duplicate flight system payload data display and downlink characteristics.

3.1.4.1.2.2.34 The Combined Training function shall provide capabilities and standard interfaces to control simulation modes including run, stop, step-ahead, checkpoint, and restart.

3.1.4.1.2.2.35 The Combined Training function shall provide the capability for standard payload simulator run-time interfaces to subsystem, environmental, and payload support simulations as defined by SSF simulation standards.

3.1.4.1.2.2.36 The Combined Training function shall provide the capability to control the training session through execution of training scripts.

3.1.4.1.2.2.37 The Combined Training function shall provide the capability for rule-based evaluation of training results in real-time.

3.1.4.1.2.2.38 The Combined Training function shall provide the capability to log training results to storage under user or script control.

3.1.4.1.2.2.39 The Combined Training function shall provide the capability to automatically modify training scripts and scenarios based upon student responses.

3.1.4.1.2.2.40 The Combined Training function shall provide simulations of natural and induced space environment affecting the Space Station.

3.1.4.1.2.2.41 The Combined Training function shall provide a simulation of ground commanding capabilities.

3.1.4.1.2.2.42 The Combined Training function shall provide the capability to collect simulation execution metrics.

3.1.4.1.2.2.43 The Combined Training function shall provide the capability to generate responses that normally come from the trainee in order to do testing and operations evaluation functions.

3.1.4.1.2.2.44 The Combined Training function shall provide the capability to operate in a consolidated payload simulation where teams of students at other operations centers, including the POIC and user operations centers (ROCs, DOCs, and UOFs), will be trained on specific flight increment objectives including reworking the short term plan, payload operations and updates, interactions with telescience operators, shift handovers, and payload malfunctions.

### 3.1.4.1.2.3 Consolidated Training

The Consolidated Training function will allow the student to train on full mockups of the U.S. Lab, Columbus, and JEM modules operating in a fully integrated payload mode. This training will allow the student to train on a complete payload increment prior to

SSTF mission increment training. Training will be provided for nominal and contingency operations and will operate at the fidelity necessary to fulfill training requirements.

Inputs
a. INTR_CONT_Simulation_Control_Commands
b. INTR_CONT_Subsystem_Simulation_Inputs
c. INTR_CONT_C_&_D_Panel_Info
d. PPOT_CONT_Payload_Data_Sets
e. PPOT_CONT_Uplink_Commands
f. PTD_CONT_Student_Inputs
g. TSET_CONT_Training_Scenario
h. SIML_CONT_Simulations
i. TSET_CONT_Training_Config
j. USER_CONT_User_Control_Commands
k. PFE_CONT_Device_Status
l. PPOT_CONT_Payload_Data_File

Outputs
a. CONT_INTR_Sim_Command_Responses
b. CONT_INTR_Simulated_Payload_Data
c. CONT_INTR_C_&_D_Panel_Info
d. CONT_SRR_Student_Records/Results
e. CONT_PFE_Device_Commands
f. CONT_PTD_Simulation_Outputs
g. CONT_USER_Responses_To_User
h. CONT_PPOT_Downlink_Data

3.1.4.1.2.3.1 The Consolidated Training function shall provide the capability to concurrently operate all training simulators for the U.S. Lab, Columbus, JEM, and attached payloads.

3.1.4.1.2.3.2 The Consolidated Training function shall provide the capability to reconfigure within 7 days from one increment to another during a training period.

3.1.4.1.2.3.3 The Consolidated Training function shall provide the capability for hardware and software rack reconfiguration.

3.1.4.1.2.3.4 The Consolidated Training function shall provide the capability for operations payload training in nominal and contingency operations for flight personnel.

3.1.4.1.2.3.5 The Consolidated Training function shall provide the capability to simulate flight audio control interfaces and control PTC representations of audio components integrated among the U.S. Lab, Columbus, and JEM modules.

3.1.4.1.2.3.6 The Consolidated Training function shall provide the capability to simulate integrated flight video control interfaces of the U.S. Lab, Columbus, JEM, and attached payloads.

3.1.4.1.2.3.7 The Consolidated Training function shall provide the capability to create, control, and manipulate payload video images.

3.1.4.1.2.3.8 The Consolidated Training function shall provide a standard interface for payload simulator manipulation of video images.

3.1.4.1.2.3.9 The Consolidated Training function shall provide the capability to control PTC video components of the U.S. Lab, Columbus, JEM modules, and attached payloads.

3.1.4.1.2.3.10 The Consolidated Training function shall provide the capability to interface with the Data Management System (DMS) kits.

3.1.4.1.2.3.11 The Consolidated Training function shall provide a standard malfunction control interface to instructors or automated scripts.

3.1.4.1.2.3.12 The Consolidated Training function shall provide the capability for automated initialization based on the simulation configuration.

3.1.4.1.2.3.13 The Consolidated Training function shall provide a standard interface for experiment control and display panels.

3.1.4.1.2.3.14 The Consolidated Training function shall receive and process uplink command inputs from the Perform POIC Cadre Training function.

3.1.4.1.2.3.15 The Consolidated Training function shall provide the capability to generate and transfer downlink data to the Perform POIC Cadre Training function.

3.1.4.1.2.3.16 The Consolidated Training function shall provide the capability for training simulators to be portable between part-task trainers, combined trainers, and consolidated trainers without modification.

3.1.4.1.2.3.17 The Consolidated Training function shall provide the capability to execute flight CUI software and emulate CUI capabilities.

3.1.4.1.2.3.18 The Consolidated Training function shall provide the capability for an emulation of flight software.

3.1.4.1.2.3.19 The Consolidated Training function shall provide the appropriate data interfaces for the operation of real/prototype payload hardware in the training environment.

3.1.4.1.2.3.20 The Consolidated Training function shall provide control and monitor interfaces for support equipment required to operate real/prototype payload hardware in the training environment.

3.1.4.1.2.3.21 The Consolidated Training function shall provide the capability to execute actual payload flight software designed for execution in DMS processors (SDP, MDM/EDP).

3.1.4.1.2.3.22 The Consolidated Training function shall provide a standard control and monitor interface for payload unique (non-DMS processors) and support equipment utilized in a training environment.

3.1.4.1.2.3.23 The Consolidated Training function shall provide the capability to execute payload simulators at frequencies sufficient to support data acquisition of flight software.

3.1.4.1.2.3.24 The Consolidated Training function shall provide the capability to execute different simulators at various fidelities.

3.1.4.1.2.3.25 The Consolidated Training function shall provide the capability to execute payload simulators at rates required to duplicate flight system payload data display and downlink characteristics.

3.1.4.1.2.3.26 The Consolidated Training function shall provide capabilities and standard interfaces to control simulation modes including run, stop, step-ahead, checkpoint, and restart.

3.1.4.1.2.3.27 The Consolidated Training function shall provide the capability for standard payload simulator run-time interfaces to subsystem, environmental, and payload support simulations as defined by SSF simulation standards.

3.1.4.1.2.3.28 The Consolidated Training function shall provide the capability to control the training session through execution of training scripts.

3.1.4.1.2.3.29 The Consolidated Training function shall provide the capability for rule-based evaluation of training results in real-time.

3.1.4.1.2.3.30 The Consolidated Training function shall provide the capability to log training results to storage under user or script control.

3.1.4.1.2.3.31 The Consolidated Training function shall provide the capability to automatically modify training scripts and scenarios based upon student responses.

3.1.4.1.2.3.32 The Consolidated Training function shall provide simulations of natural and induced space environment affecting the Space Station.

3.1.4.1.2.3.33 The Consolidated Training function shall provide a simulation of ground commanding capabilities.

3.1.4.1.2.3.34 The Consolidated Training function shall provide the capability to collect simulation execution metrics.

3.1.4.1.2.3.35 The Consolidated Training function shall provide the capability to generate responses that normally come from the trainee in order to do testing and operations evaluation functions.

### 3.1.4.1.2.4 Integrated Training

The Integrated Training function will allow the SCS to support CI Training on-site at JSC by operating in an integrated mode with the SSTF. This function will allow the student to train on a full mockup for the entire mission increment at JSC. See PTC/SSTF I/F Req Document, 31 July '89.

Inputs
a. SSTF_INTR_Subsystem_Simulation_Inputs
b. SIML_INTR_Simulations
c. SSTF_INTR_C_&_D_Panel_Info
d. CONT_INTR_Sim_Command_Responses
e. CONT_INTR_Simulated_Payload_Data
f. CONT_INTR_C_&_D_Panel_Info
g. SSTF_INTR_Simulation_Control_Commands

Outputs
a. INTR_SSTF_Simulated_Payload_Data
b. INTR_SSTF_Sim_Command_Responses
c. INTR_SSTF_C_&_D_Panel_Info
d. INTR_CONT_Simulation_Control_Commands
e. INTR_CONT_Subsystem_Simulation_Inputs
f. INTR_CONT_C_&_D_Panel_Info

3.1.4.1.2.4.1 The SSTF Integrated Training function shall provide an interface to the Consolidated Training function to support concurrent operations with the SSTF.

3.1.4.1.2.4.2 The SSTF Integrated Training function shall provide the capabilities for the SSTF monitoring and control of the Consolidated Training function.

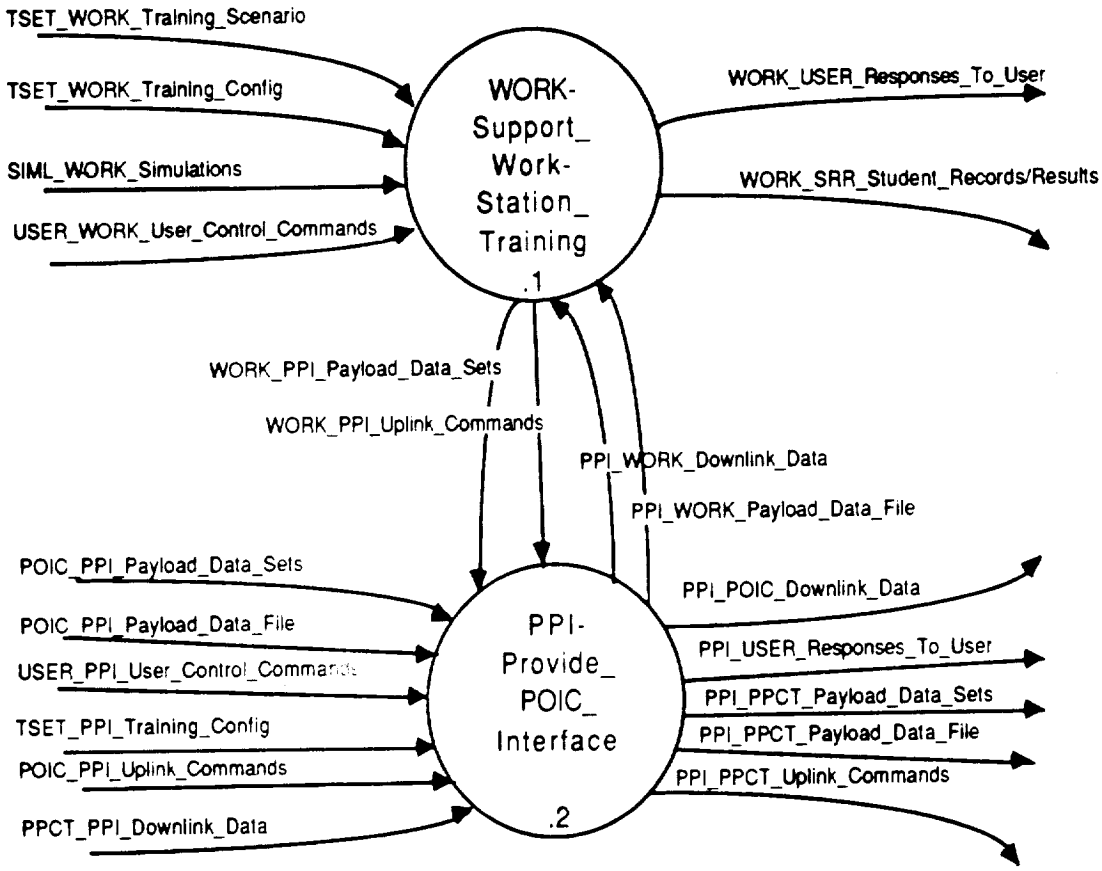
3.1.4.1.2.4.3 The SSTF Integrated Training function shall support an on-site Consolidated Training function at the SSTF.

### 3.1.4.1.3 POIC Cadre Training

Figure 3-9 DF/1.3 shows the SCS POIC cadre training functions and the associated data flows. The POIC cadre training functions are as follows:

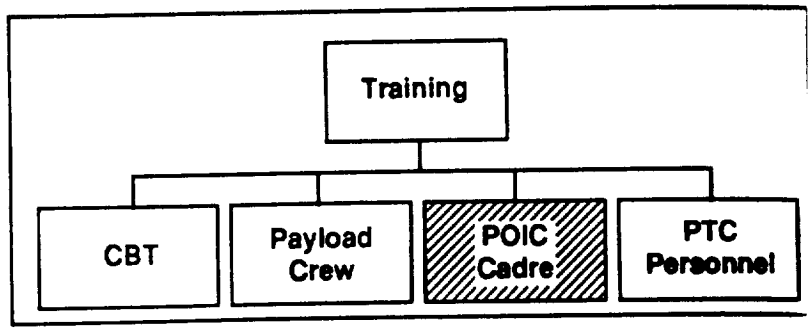
1. Work-Station Training

2. POIC Interface




**DF/1.3 Perform POIC Cadre Training**

**Figure 3-9**



#### 3.1.4.1.3.1 POIC Workstation Training

The POIC Workstation Training function provides training for the Payload Operations Integration Center (POIC) controllers both before the POIC is available for use, and after it becomes fully operational and occupied. This function will operate in conjunction with the payload crew training function or in a stand-alone mode.

Inputs
a. TSET_WORK_Training_Scenario
b. TSET_WORK_Training_Config
c. SIML_WORK_Simulations
d. USER_WORK_User_Control_Commands
e. PPI_WORK_Downlink_Data
f. PPI_WORK_Payload_Data_File

Outputs
a. WORK_USER_Responses_To_User
b. WORK_SRR_Student_Records/Results
c. WORK_PPI_Payload_Data_Sets
d. WORK_PPI_Uplink_Commands

3.1.4.1.3.1.1 The Support Work-Station Training function shall provide the capability to support 7 simultaneous training sessions on 7 different baselined increment configurations.

3.1.4.1.3.1.2 The Support Work-Station Training function shall provide the capability for any training session to run integrated with any combined or consolidated training session on any baselined increment configuration.

3.1.4.1.3.1.3 The Support Work-Station Training function shall provide the capability to support full command uplink capability.

3.1.4.1.3.1.4 The Support Work-Station Training function shall provide the capability to process downlink data and to generate downlink data in a stand-alone mode.

3.1.4.1.3.1.5 The Support Work-Station Training function shall provide the capability to generate table-driven, high-rate, science telemetry data in packet form.

3.1.4.1.3.1.6 The Support Work-Station Training function shall provide the capability to modify high-rate, science telemetry data based on payload simulator mode changes.

3.1.4.1.3.1.7 The Support Work-Station Training function shall provide the capability to operate in a stand-alone mode (i.e., without payload crew training in active mode).

3.1.4.1.3.1.8 The Support Work-Station Training function shall provide the capability for automated initialization based on the simulation configuration.

3.1.4.1.3.1.9 The Support Work-Station Training function shall provide the capability to execute POIC CUI software or emulate POIC CUI capabilities.

3.1.4.1.3.1.10 The Support Work-Station Training function shall provide displays and interaction that appear and behave as those on the actual POIC consoles.

3.1.4.1.3.1.11 The Support Work-Station Training function shall provide the capability to support executions of simulation of POIC interfaces to MPS, SSCC, payload data file generation software, data flow analysis simulator, operations management information system, and payload operations ground applications (POGA).

3.1.4.1.3.1.12 The Support Work-Station Training function shall provide the capabilities and standard interfaces to control simulation modes including run, stop, step-ahead, checkpoint, and restart.

3.1.4.1.3.1.13 The Support Work-Station Training function shall provide the capability to control the training session through execution of training scripts.

3.1.4.1.3.1.14 The Support Work-Station Training function shall provide the capability for rule-based evaluation of training results in real-time.

3.1.4.1.3.1.15 The Support Work-Station Training function shall provide the capability to log training results to storage under user or script control.

3.1.4.1.3.1.16 The Support Work-Station Training function shall provide the capability to automatically modify training scripts and scenarios based upon student responses.

### 3.1.4.1.3.2 Provide POIC Interface

The Provide POIC Interface function provides a switching mechanism between the PTC trainers, POIC workstation trainers, and the POIC. This function determines the appropriate routing path for uplink and downlink data to/from the POIC directed either to/from the payload crew training function and/or the POIC workstation training function.

Inputs
a. WORK_PPI_Uplink_Commands
b. WORK_PPI_Payload_Data_Sets
c. USER_PPI_User_Control_Commands
d. PPCT_PPI_Downlink_Data
e. POIC_PPI_Uplink_Commands
f. TSET_PPI_Training_Config
g. POIC_PPI_Payload_Data_Sets
h. POIC_PPI_Payload_Data_File

Outputs
a. PPI_WORK_Payload_Data_File
b. PPI_WORK_Downlink_Data
c. PPI_PPCT_Uplink_Commands

d. PPI_PPCT_Payload_Data_Sets
e. PPI_PPCT_Payload_Data_File
f. PPI_USER_Responses_To_User
g. PPI_POIC_Downlink_Data

3.1.4.1.3.2.1 The Provide POIC Interface function shall provide the capability to support approved input and output communication standards and protocols established by the POIC.

3.1.4.1.3.2.2 The Provide POIC Interface function shall provide the capability to act as a switching mechanism in directing uplink and downlink data to/from the POIC workstation training or POIC.

3.1.4.1.3.2.3 The Provide POIC Interface function shall provide the capability for the hardware interface established by the POIC.

3.1.4.1.3.2.4 The Provide POIC Interface function shall provide the capability to configure the hardware interface and associated communication protocol in accordance with the training configuration.

3.1.4.1.3.2.5 The Provide POIC Interface function shall provide the capability for users to control and monitor the data routing configuration.

### 3.1.4.1.4 PTC Personnel Training

The PTC Personnel Training function fulfills training requirements for instructors, developers, and operators of the PTC/SCS facility. This function will allow the users to be trained on facility equipment and payload increments as necessary. PIs are not considered PTC personnel.

Inputs
a. USER_PPPT_User_Control_Commands
b. PTD_PPPT_Student_Inputs
c. TSET_PPPT_Training_Config
d. TSET_PPPT_Training_Scenario

Outputs
a. PPPT_USER_Responses_To_User
b. PPPT_PTD_Simulation_Outputs

3.1.4.1.4.1 The Perform PTC Personnel Training function shall provide a set of user capabilities as defined in training and development requirements which will provide SCS operations training for SCS users.

3.1.4.1.4.2 The Perform PTC Personnel Training function shall isolate activities of SCS user trainees from effects on operational SCS training configurations and data items.

### 3.1.4.2 Development Functions

The Development functions encompass a wide range of areas that are necessary prior to and after the training cycle. Support functions include performing front end training analysis, developing training plans and training scenarios by inputs from training requirements, building a training configuration and training script for a specific payload increment, developing courseware for computer based training, and performing a training results analysis by comparing student results with expected results. Actual simulator development functions include analyzing simulator requirements to determine the exact specifications for a needed simulator, designing the simulator and producing any correlating documentation, implementing the simulator whether it be in hardware or software, the actual testing of the simulator as a unit, submission of the simulator to configuration management, and any maintenance or sustaining engineering that will be needed in the future. In completing the cycle of simulator development, the simulator undergoes integration into a set of payload simulators regardless of whether it was developed internally or externally to the SCS. To conclude the development path of a payload simulator, the simulator is integrated into the operational PTC which is the actual training environment. Figure 3-10 DF/2 shows the SCS development functions and the associated data flows. The development functions are as follows:

1. Support Functions -- Includes training, analysis, and planning, setup, CBT courseware development, and training results analysis.

2. Simulator Development -- Includes simulator requirements analysis, simulator design, simulator implementation, simulator testing, configuration management, and maintenance.

3. Simulator Integration -- Includes integration of internally developed payload simulators, integration of externally developed payload simulators, and final integration of payload simulators into the operational PTC.

#### 3.1.4.2.1 Support Functions

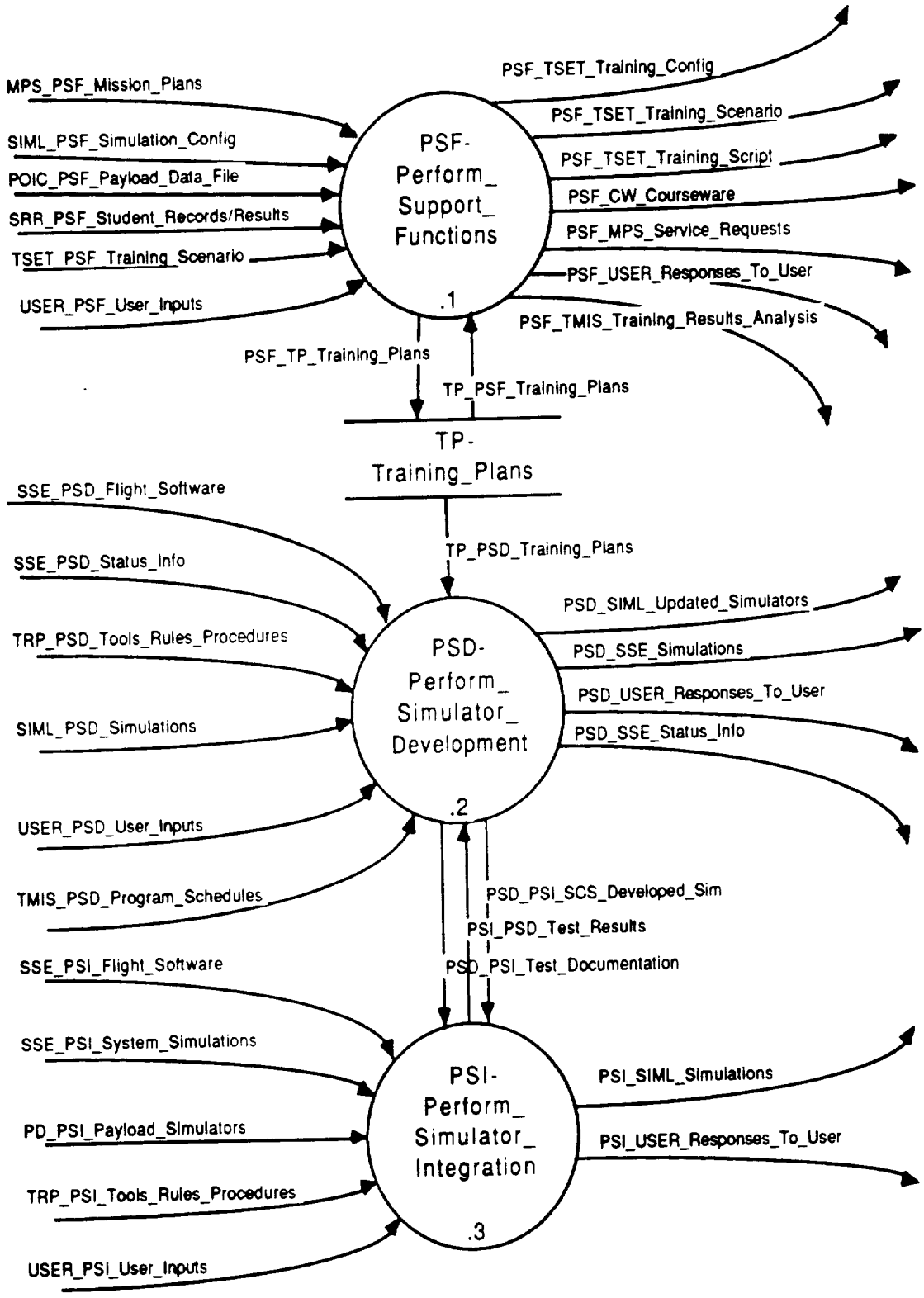
The Support Functions are those necessary prior to or after the actual training occurs. They include deriving training requirements preparing training plans, scenarios, and scripts, determining training configurations, developing CBT courseware, and analyzing training results. Figure 3-11 DF/2.1 shows the SCS support functions and the associated data flows. The support functions are as follows:

1. Training Planning

2. Setup

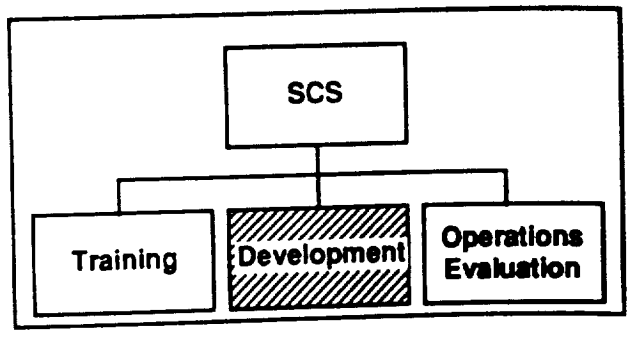
3. CBT Courseware Development

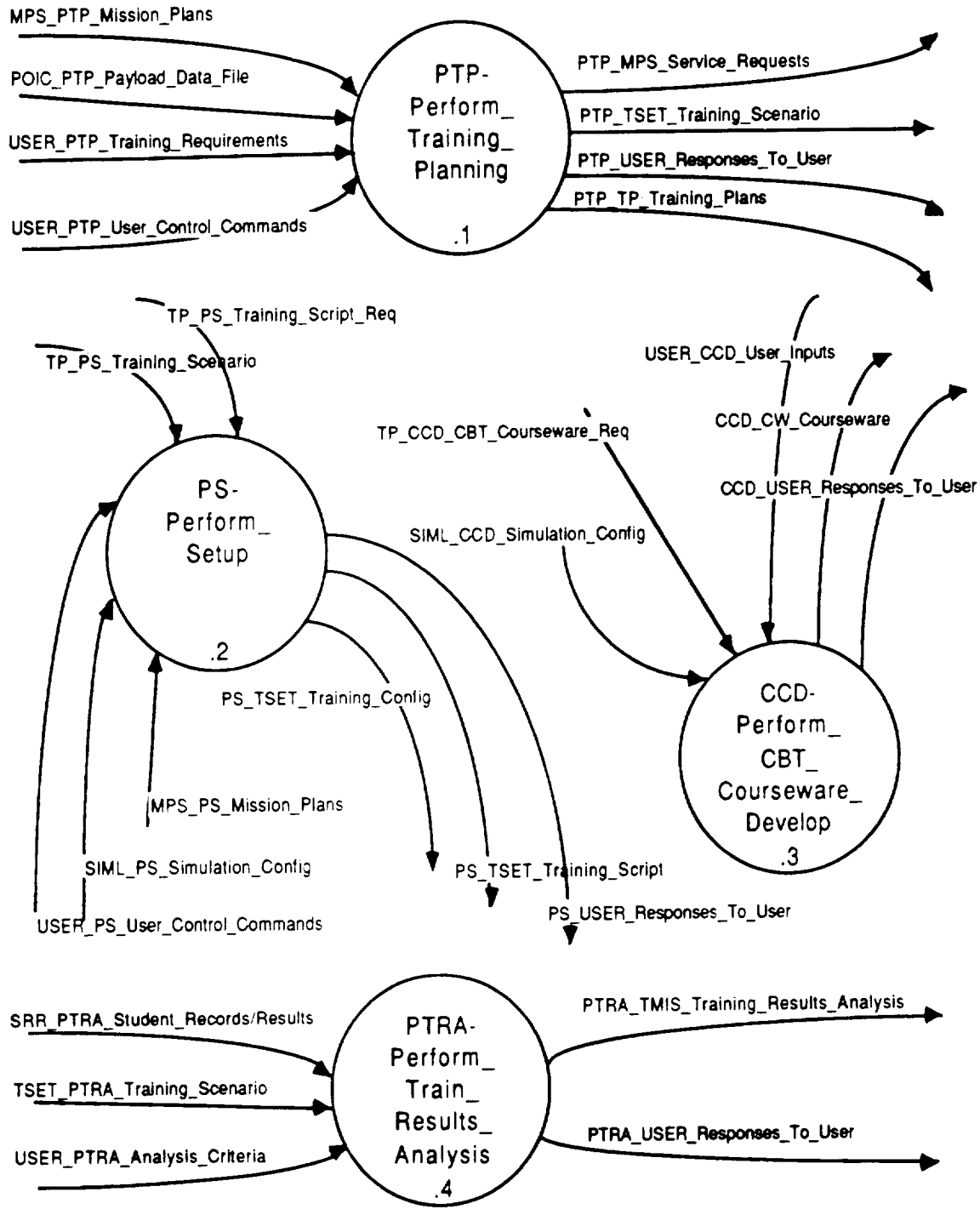
4. Training Results Analysis




**DF/2 Perform Development Functions**

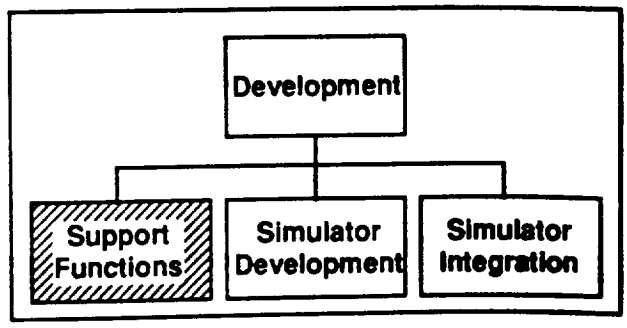
**Figure 3-10**






**DF/2.1 Perform Support Functions**

**Figure 3-11**



#### 3.1.4.2.1.1 Training Planning

Inputs
a. POIC_PTP_Payload_Data_File
b. USER_PTP_Training_Requirements
c. USER_PTP_User_Control_Commands
d. MPS_PTP_Mission_Plans

Outputs
a. PTP_USER_Responses_To_User
b. PTP_TSET_Training_Scenario
c. PTP_PS_Training_Scenario
d. PTP_MPS_Service_Requests
e. PTP_TP_Training_Plans

3.1.4.2.1.1.1 The Perform Training Planning function shall provide capabilities for information inputs from the MPS, user, and POIC.

3.1.4.2.1.1.2 The Perform Training Planning function shall provide capabilities for scheduling training classes, maintenance, and other usage of the PTC facility.

3.1.4.2.1.1.3 The Perform Training Planning function shall provide the capability to schedule the PTC components within constraints of forecasts and available resources.

3.1.4.2.1.1.4 The Perform Training Planning function shall provide the capability to collect and process facility usage statistics for comparison with forecasts and schedules.

3.1.4.2.1.1.5 The Perform Training Planning function shall provide capabilities to produce training definition documents which include outline of courses, lesson summaries, and key events during training sessions.

3.1.4.2.1.1.6 The Perform Training Planning function shall provide the capability to produce scenarios for specific training sessions by utilizing training requirements.

3.1.4.2.1.1.7 The Perform Training Planning function shall provide the capability to organize experiment and other data into a database in terms of the mission or purpose, functions to satisfy the mission, major subsystems and components used to structure the system, equipment/materials required to support the system, established concepts, policies or procedures for system operation, maintenance or use, functional responsibilities of the people who will operate, maintain or use the system.

3.1.4.2.1.1.8 The Perform Training Planning function shall provide the capability to analyze the database and to identify all the tasks required to operate, maintain, and control the experiment.

3.1.4.2.1.1.9 The Perform Training Planning function shall provide the capability to specify how instructional material will be taught (such as by CBT, classroom, etc.) and in what sequence of curricula.

3.1.4.2.1.1.10 The Perform Training Planning function shall provide the capability to produce instructional materials such as training scripts, classroom syllabi, etc.

### 3.1.4.2.1.2 Setup

Inputs
a. PTP_PS_Training_Scenario
b. SIML_PS_Simulation_Config
c. USER_PS_User_Control_Commands
d. MPS_PS_Mission_Plans
e. TP_PS_Training_Plans

Outputs
a. PS_USER_Responses_To_User
b. PS_TSET_Training_Script
c. PS_TSET_Training_Config

3.1.4.2.1.2.1 The Perform Setup function shall provide the capability to automate creation of a run-time configuration file by utilizing simulator configuration data and training plans.

3.1.4.2.1.2.2 The Perform Setup function shall provide the capability to extract data from crew procedures to determine setup and configuration for a specific training script.

3.1.4.2.1.2.3 The Perform Setup function shall provide the capability to determine all software configurations within any training configuration.

3.1.4.2.1.2.4 The Perform Setup function shall provide the capability to determine hardware configurations within any training configuration.

### 3.1.4.2.1.3 CBT Courseware Development

Inputs
a. USER_CCD_User_Inputs
b. SIML_CCD_Simulation_Config
c. TP_CCD_Training_Plans

Outputs
a. CCD_USER_Responses_To_User
b. CCD_CW_Courseware

3.1.4.2.1.3.1 The Perform CBT Courseware Development function shall provide the capability to develop courseware for computer based training for the payload crew, POIC cadre, and PTC personnel.

3.1.4.2.1.3.2 The Perform CBT Courseware Development function shall provide the capability to develop courseware for a tutorial session for the beginning student to train for a specific increment.

3.1.4.2.1.3.3 The Perform CBT Courseware Development function shall provide the capability for courseware source input and editing.

3.1.4.2.1.3.4 The Perform CBT Courseware Development function shall provide the capability for compilation of courseware.

3.1.4.2.1.3.5 The Perform CBT Courseware Development function shall provide the capability to produce menu-driven, windows, and/or icon instructional courseware in order to meet the dynamic needs of the student.

3.1.4.2.1.3.6 The Perform CBT Courseware Development function shall provide the capability for instructional paths based upon trainee responses.

3.1.4.2.1.3.7 The Perform CBT Courseware Development function shall provide the capability to develop courseware for different levels of expertise training.

3.1.4.2.1.3.8 The Perform CBT Courseware Development function shall have the capability to call subroutines and interface to other programs for data collection and statistical analysis.

3.1.4.2.1.3.9 The Perform CBT Courseware Development function shall provide the capability for defaults on training options.

3.1.4.2.1.3.10 The Perform CBT Courseware Development function shall provide the capability for high quality graphics equivalent to the Space Station Multi-purpose Application Console (MPAC).

3.1.4.2.1.3.11 The Perform CBT Courseware Development function shall provide the capability for video equivalent to the Space Station Multi-purpose Application Console (MPAC).

3.1.4.2.1.3.12 The Perform CBT Courseware Development function shall provide the capability for audio equivalent to the Space Station Multi-purpose Application Console (MPAC).

3.1.4.2.1.3.13 The Perform CBT Courseware Development function shall provide the capability for a friendly, consistent, developer interface with the ability to provide student control and event-driven interactions.

3.1.4.2.1.3.14 The Perform CBT Courseware Development function shall provide the capability to create training courseware that represents all the basic USE capabilities as defined within the SSE.

3.1.4.2.1.3.15 The Perform CBT Courseware Development function shall provide the capability to scan the training plans for data necessary to develop CBT courseware which will be given to the course builder.

### 3.1.4.2.1.4 Training Results Analysis

Inputs
a. TSET_PTRA_Training_Scenario
b. USER_PTRA_Analysis_Criteria
c. SRR_PTRA_Student_Records/Results

Outputs
a. PTRA_USER_Responses_To_User
b. PTRA_TMIS_Training_Results_Analysis

3.1.4.2.1.4.1 The Perform Training Results Analysis function shall provide the capability for payload crew, POIC cadre, and PTC personnel student inputs to be compared with expected responses. However, PTC personnel results will not be sent to TMIS.

3.1.4.2.1.4.2 The Perform Training Results Analysis function shall provide the capability to evaluate all training results from computer based training, part-task training, combined training, consolidated training, and POIC work-station training.

3.1.4.2.1.4.3 The Perform Training Results Analysis function shall provide the capability for automatic data analysis to send data to the SSTF for training results analysis during an integrated training session.

3.1.4.2.1.4.4 The Perform Training Results Analysis function shall provide the capability to analyze and produce reports from student records and training results of previous training sessions in an automated fashion.

3.1.4.2.1.4.5 The Perform Training Results Analysis function shall provide capabilities to compare student inputs with expected results from scenarios through an automated process.

3.1.4.2.1.4.6 The Perform Training Results Analysis function shall provide the capability to automatically format testing results and send them to TMIS excluding PTC personnel results.

3.1.4.2.1.4.7 The Perform Training Results Analysis function shall provide the capability for the instructor to define the analysis criteria to be met by student results.

### 3.1.4.2.2 Simulator Development

The Simulator Development Function follows the path of building a simulator from its conception. A requirements analysis is first conducted to determine exact simulator specifications, then comes the actual design of the simulator. Any documentation relative to the design or testing of the simulator is generated as the simulator is

designed, and utilized later in the implementation and testing of the simulator. To complete the development cycle, the simulator is placed under configuration management and maintenance/sustaining engineering. Figure 3-12 DF/2.2 shows the SCS simulator development functions and the associated data flows and data stores. The simulator development functions are as follows:

1. Simulator Requirements Analysis
2. Design Simulator
3. Implement Simulator
4. Test Simulator
5. Configuration Management
6. Maintenance

#### 3.1.4.2.2.1 Simulator Requirements Analysis

Inputs
a. USER_PSRA_Training_Requirements
b. USER_PSRA_User_Control_Commands
c. TRP_PSRA_Req_Tools

Outputs
a. PSRA_TD_Test_Plans
b. PSRA_USER_Responses_To_User
c. PSRA_SR_Simulator_Req

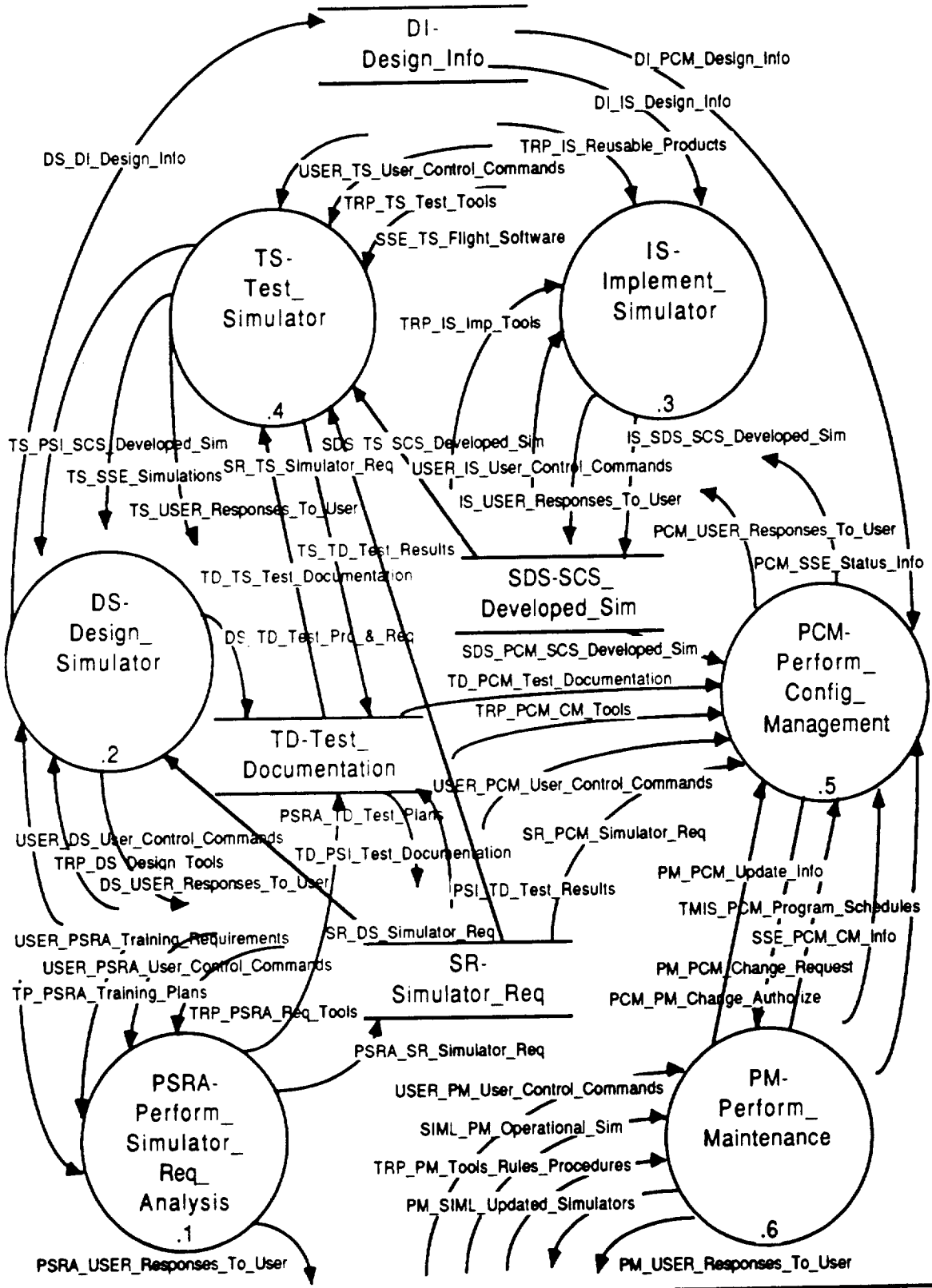
3.1.4.2.2.1.1 The Perform Simulator Requirements Analysis function shall support requirements definition for PTC operational (increment independent) software and PTC prototypes and simulators. Requirements definition includes functional analysis, data analysis, interface analysis, and specification of the requirements.

3.1.4.2.2.1.2 The Perform Simulator Requirements Analysis function shall support requirement analysis and allocation for PTC prototypes and simulators.

3.1.4.2.2.1.3 The Perform Simulator Requirements Analysis function shall support requirements and analytical modeling for PTC operational software and PTC prototypes and simulators.

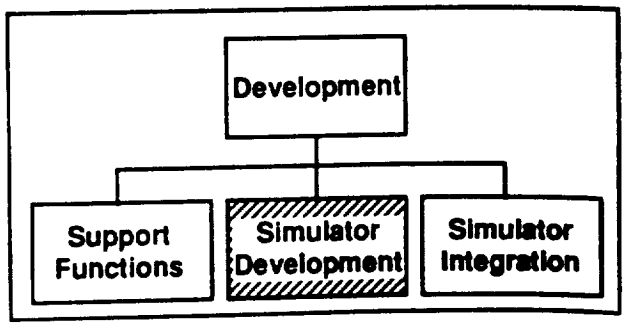
3.1.4.2.2.1.4 The Perform Simulator Requirements Analysis function shall support traceability from PTC operational software and PTC prototypes and simulators requirements specifications to customer supplied documentation (e.g. training requirements) specifying system functionality and performance.

3.1.4.2.2.1.5 The Perform Simulator Requirements Analysis function shall support fault analysis of requirements for PTC operational software and PTC simulators.




**DF/2.2 Perform Simulator Development**

**Figure 3-12**



3.1.4.2.2.1.6 The Perform Simulator Requirements Analysis function shall maintain the current development status of in-work requirements, components of PTC operational software, and PTC prototypes and simulators which are under configuration management.

3.1.4.2.2.1.7 The Perform Simulator Requirements Analysis function shall provide the capability to develop unit test plans for payload simulators.

### 3.1.4.2.2.2 Design Simulator

Inputs
a. SR_DS_Simulator_Req
b. USER_DS_User_Control_Commands
c. TRP_DS_Design_Tools

Outputs
a. DS_TD_Test_Pro_&_Req
b. DS_DI_Design_Info
c. DS_USER_Responses_To_User

3.1.4.2.2.2.1 The Design Simulator function shall support design of PTC operational software and PTC simulators. Design includes development of alternate design concepts, trade-off analysis, and design optimization.

3.1.4.2.2.2.2 The Design Simulator function shall support a primary PTC design methodology based on an Ada Programming Support Environment (APSE) per the SSE.

3.1.4.2.2.2.3 The Design Simulator function shall support computer-aided design for PTC operational software and PTC simulators.

3.1.4.2.2.2.4 The Design Simulator function shall support computer-aided design for hardware panel design.

3.1.4.2.2.2.5 The Design Simulator function shall support design analysis of PTC operational software and PTC simulators.

3.1.4.2.2.2.6 The Design Simulator function shall support design prototyping of PTC operational software and PTC simulators.

3.1.4.2.2.2.7 The Design Simulator function shall support traceability from the PTC operational software and PTC simulators design to the PTC operational software and PTC simulators requirements specifications.

3.1.4.2.2.2.8 The Design Simulator function shall support reuse of design products, methods, and tools for PTC operational software and PTC simulators.

3.1.4.2.2.2.9 The Design Simulator function shall support design fault analysis for PTC operational software and PTC simulators.

3.1.4.2.2.2.10 The Design Simulator function shall maintain the current development status of in-work design components of PTC operational software and PTC simulators which are under configuration management.

3.1.4.2.2.2.11 The Design Simulator function shall provide the capability to produce PTC operational software and PTC simulators test procedures and requirements.

### 3.1.4.2.2.3 Implement Simulator

Inputs
a. DI_IS_Design_Info
b. TRP_IS_Imp_Tools
c. USER_IS_User_Control_Commands
d. TRP_IS_Reusable_Products

Outputs
a. IS_USER_Responses_To_User
b. IS_SDS_SCS_Developed_Sim

3.1.4.2.2.3.1 The Implement Simulator function shall support PTC operational software and PTC prototypes and simulators implementation. Implementation includes software program coding, hardware development, data development, and documentation.

3.1.4.2.2.3.2 The Implement Simulator function shall support unit testing for PTC operational software and PTC prototypes and simulators.

3.1.4.2.2.3.3 The Implement Simulator function shall enforce PTC operational software and PTC simulator coding standards.

3.1.4.2.2.3.4 The Implement Simulator function shall provide capabilities to create and transfer PTC operational software and PTC simulators.

3.1.4.2.2.3.5 The Implement Simulator function shall support traceability from the implementation of PTC operational software and PTC simulators to the detailed design of PTC operational software and PTC models and simulators.

3.1.4.2.2.3.6 The Implement Simulator function shall support reuse of implementation products from PTC operational software, PTC simulators, and products from the SSE.

3.1.4.2.2.3.7 The Implement Simulator function shall maintain the current development status of in-work implementation components of PTC operational software and PTC simulators which are under configuration management.

3.1.4.2.2.3.8 The Implement Simulator function shall provide an on-line, interactive, symbolic debugger.

### 3.1.4.2.2.4 Test Simulator

Inputs
a. SR_TS_Simulator_Req
b. TD_TS_Test_Documentation
c. SDS_TS_SCS_Developed_Sim
d. SSE_TS_Flight_Software
e. TRP_TS_Test_Tools
f. USER_TS_User_Control_Commands

Outputs
a. TS_TD_Test_Results
b. TS_PSI_SCS_Developed_Sim
c. TS_USER_Responses_To_User
d. TS_SSE_Simulations

3.1.4.2.2.4.1 The Test Simulator function shall provide the capabilities for testing of PTC software products and hardware products. Testing includes integration testing of a collection of units and hardware and software integration.

3.1.4.2.2.4.2 The Test Simulator function shall support software instrumentation and execution monitoring of simulators during software testing.

3.1.4.2.2.4.3 The Test Simulator function shall support the definition of test levels (e.g. CSC and CSCI) for all life-cycle products.

3.1.4.2.2.4.4 The Test Simulator function shall support testing with interfaces to the Space Station Data Management System (DMS) kits.

3.1.4.2.2.4.5 The Test Simulator function shall support the execution of tests involving different combinations of simulators and real SSF flight software.

3.1.4.2.2.4.6 The Test Simulator function shall provide the capability to compare the operation of different testing configurations.

3.1.4.2.2.4.7 The Test Simulator function shall provide the capability to include software simulators in testing of PTC operational software.

3.1.4.2.2.4.8 The Test Simulator function shall utilize test plans, procedures, and requirements to verify payload simulators.

3.1.4.2.2.4.9 The Test Simulator function shall ensure that payload simulators meet performance and fidelity requirements.

3.1.4.2.2.4.10 The Test Simulator function shall support completion of testing documentation through incorporation of test results.

3.1.4.2.2.4.11 The Test Simulator function shall support the execution of automated testing procedures for individual payload simulators.

### 3.1.4.2.2.5 Configuration Management

Inputs
a. PM_PCM_Update_Info
b. TRP_PCM_CM_Tools
c. TMIS_PCM_Program_Schedules
d. SR_PCM_Simulator_Req
e. DI_PCM_Design_Info
f. PM_PCM_Change_Request
g. USER_PCM_User_Control_Commands
h. SSE_PCM_CM_Info
i. TD_PCM_Test_Documentation
j. SDS_PCM_SCS_Developed_Sim

Outputs
a. PCM_PM_Change_Authorize
b. PCM_SSE_Status_Info
c. PCM_USER_Responses_To_User

3.1.4.2.2.5.1 The Perform Configuration Management function shall have the capability for configuration access control and configuration management functions to exchange data with the equivalent TMIS and SSE System capabilities.

3.1.4.2.2.5.2 The Perform Configuration Management function shall provide capabilities for software configuration management based on the top-level program-wide SSF configuration management policy.

3.1.4.2.2.5.3 The Perform Configuration Management function shall support the definition of the items placed under configuration management.

3.1.4.2.2.5.4 The Perform Configuration Management function shall support the identification of the characteristics of the items under configuration management and the relationships among them.

3.1.4.2.2.5.5 The Perform Configuration Management function shall provide the capability to distinguish between different configuration item data types (i.e., software, procedures, standards, hardware specifications, policy and training material, other documentation, etc.).

3.1.4.2.2.5.6 The Perform Configuration Management function shall ensure that information in use by one process cannot be modified by another without authorization.

3.1.4.2.2.5.7 The Perform Configuration Management function shall control access to all items under configuration management control.

3.1.4.2.2.5.8 The Perform Configuration Management function shall enforce defined limits on the user's ability to view, add, delete, or change any information which is under configuration management.

3.1.4.2.2.5.9 The Perform Configuration Management function shall provide the capability to restrict access to sensitive software and data which is under configuration management.

3.1.4.2.2.5.10 The Perform Configuration Management function shall provide the capability to record all occurrences of rejected configuration item access, allowed configuration item access, or both.

3.1.4.2.2.5.11 The Perform Configuration Management function shall provide the capability to determine differences between parent and child versions of a configuration item.

3.1.4.2.2.5.12 The Perform Configuration Management function shall provide the capability to recreate a specific version of a configuration item.

3.1.4.2.2.5.13 The Perform Configuration Management function shall provide the capability to verify the validity of references in one configuration item to other configuration items.

3.1.4.2.2.5.14 The Perform Configuration Management function shall provide the capability to test a configured database for consistency and currency with respect to audit trail and traceability information recorded from database transactions.

3.1.4.2.2.5.15 The Perform Configuration Management function shall provide the capability to collect and dispose of out-of-date versions of configuration items.

3.1.4.2.2.5.16 The Perform Configuration Management function shall provide the capability to maintain, track, and control multiple concurrent versions of products.

3.1.4.2.2.5.17 The Perform Configuration Management function shall provide for control of multiple classes of each configuration item as well as for transfer of items between these classes.

3.1.4.2.2.5.18 The Perform Configuration Management function shall provide the capability to track a configuration item's version history along with any processes/products used in its transformation from its original state to its current state.

3.1.4.2.2.5.19 The Perform Configuration Management function shall maintain the following information relative to a configuration item's current state: active and pending problems/changes, proposed solutions, related activities, and acquired approvals.

3.1.4.2.2.5.20 The Perform Configuration Management function shall control the component-level configuration of a PTC software build.

3.1.4.2.2.5.21 The Perform Configuration Management function shall control the collection of all configuration items comprised by a single PTC software release.

3.1.4.2.2.5.22 The Perform Configuration Management function shall provide the capability to coordinate and control specific releases of a PTC software build.

3.1.4.2.2.5.23 The Perform Configuration Management function shall maintain the following information for each PTC software release: component versions, resolved and unresolved changes and problems, and tailoring and installation instructions.

3.1.4.2.2.5.24 The Perform Configuration Management function shall support the generation and automatic tracking of change requests and problem reports for configuration items, including tracking of the approval process.

3.1.4.2.2.5.25 The Perform Configuration Management function shall provide the capability to automatically identify all PTC product components which are affected by a documented problem.

3.1.4.2.2.5.26 The Perform Configuration Management function shall provide the capability to categorize a reported problem according to its criticality and to prioritize problems based upon criticality.

3.1.4.2.2.5.27 The Perform Configuration Management function shall support notification to affected users of a reported and verified problem.

3.1.4.2.2.5.28 The Perform Configuration Management function shall provide the capability to define and enforce rules for implementing approved changes to controlled items.

3.1.4.2.2.5.29 The Perform Configuration Management function shall provide the capability to change controlled items subject to obtaining the requisite approval.

3.1.4.2.2.5.30 The Perform Configuration Management function shall provide the capability to identify the implementation sequence for approved changes to controlled items.

3.1.4.2.2.5.31 The Perform Configuration Management function shall provide the capability to identify all PTC product components which have the potential to be affected by a proposed change.

3.1.4.2.2.5.32 The Perform Configuration Management function shall provide the capability to determine the complexity and criticality of a proposed change and to prioritize proposed changes based upon those metrics.

3.1.4.2.2.5.33 The Perform Configuration Management function shall provide the capability to generate reports of configuration status, including PTC software version/revision status and change/problem status.

3.1.4.2.2.5.34 The Perform Configuration Management function shall provide the capability to generate statistical reports for configuration items based upon change/problem historical data.

3.1.4.2.2.5.35 The Perform Configuration Management function shall provide the capability to generate reports from PTC software version historical data (including the mapping of products and processes to software versions).

3.1.4.2.2.5.36 The Perform Configuration Management function shall provide the capability to generate component dependency and inversion (e.g., "where used") reports for specific PTC software configurations.

3.1.4.2.2.5.37 The Perform Configuration Management function shall provide the capability to generate an end-item inventory report listing where a completed product is installed and who is responsible for each copy.

3.1.4.2.2.5.38 The Perform Configuration Management function shall provide the capability to report, for a given product: change history, waiver status, audit/review status, traceability among components, associated development tools and their versions, and critical software items.

3.1.4.2.2.5.39 The Perform Configuration Management function shall provide the capability to identify all objects (software, documentation, etc.) to be affected by a proposed change, assess the magnitude of the effort to implement the change, and create project schedules and estimated costs for making the change.

3.1.4.2.2.5.40 The Perform Configuration Management function shall maintain and control the relationships (and corresponding traceability) between items under configuration control.

3.1.4.2.2.5.41 The Perform Configuration Management function shall provide the capability to ensure the consistency of configuration item interdependencies. These capabilities include at least the following: parent-child difference generation, application of a set of parent-child differences to modify a controlled item, and verification of the validity of references in an item to other items under configuration management.

3.1.4.2.2.5.42 The Perform Configuration Management function shall provide the capability to maintain control on all CBT developed courseware.

3.1.4.2.2.5.43 The Perform Configuration Management function shall provide the capability to collect and process facility utilization data.

3.1.4.2.2.5.44 The Perform Configuration Management function shall provide the capability to handle requests and changes from the SSTF.

#### 3.1.4.2.2.6 Maintenance

Inputs
a. PCM_PM_Change_Authorize
b. USER_PM_User_Control_Commands
c. SIML_PM_Operational_Sim
d. TRP_PM_Tools_Rules_Procedures

Outputs
a. PM_PCM_Update_Info
b. PM_PCM_Change_Request
c. PM_SIML_Updated_Simulators
d. PM_USER_Responses_To_User

3.1.4.2.2.6.1 The Perform Maintenance function shall support the maintenance and revision of PTC models and simulators.

3.1.4.2.2.6.2 The Perform Maintenance function shall provide the capabilities to determine and maintain model relationships and dependencies, to track model usage in simulators, and to inform users of model availability, operational performance and known limitations.

3.1.4.2.2.6.3 The Perform Maintenance function shall provide the capability to maintain all PTC operational software.

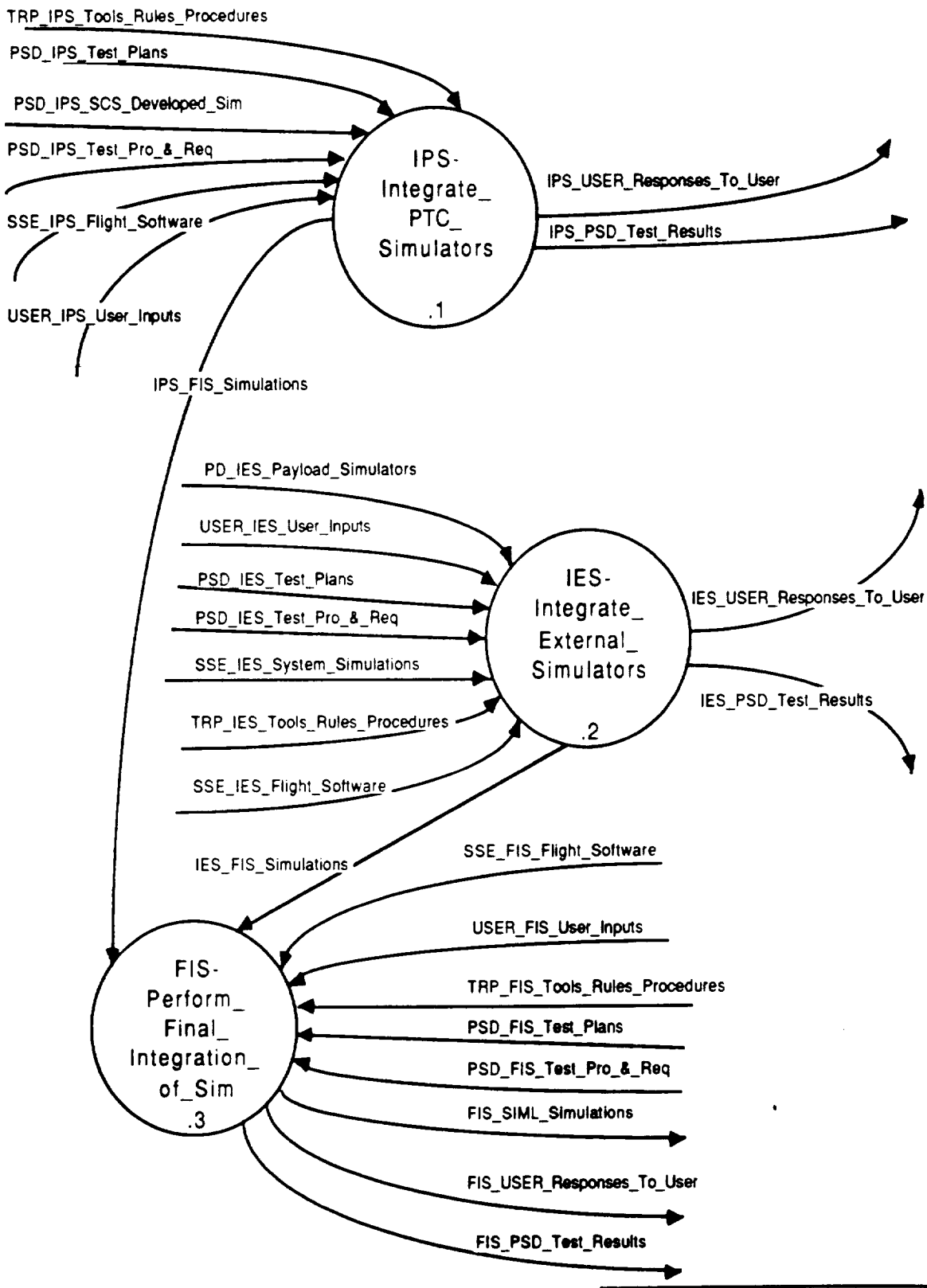
3.1.4.2.2.6.4 The Perform Maintenance function shall communicate and provide update information on payload simulators to configuration management.

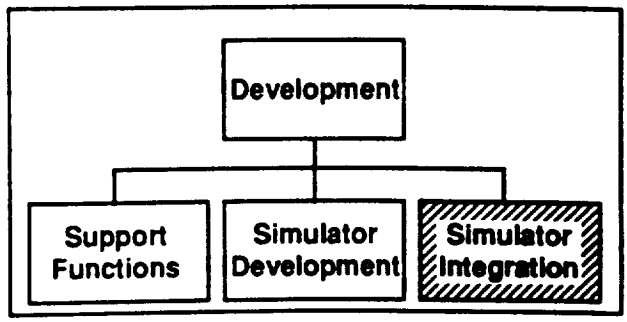
3.1.4.2.2.6.5 The Perform Maintenance function shall utilize test procedures and requirements to verify updated payload simulators.

### 3.1.4.2.3 Simulator Integration

The Simulator Integration Function provides the capability to integrate a payload simulator with other payload simulators and with the operational PTC (actual training environment). Whether the payload simulator was developed internally utilizing the SCS or externally, by a PI for example, the simulator undergoes integration into a set of payload simulators. After successful completion of this subset testing, the payload simulator is then integrated into the actual training environment. This last integration into the operational PTC includes acceptance testing and certification of an increment. Figure 3-13 DF/2.3 shows the SCS simulator integration functions and the associated data flows. The simulator integration functions are as follows:

1. Integrate PTC Simulators
2. Integrate External Simulators
3. Final Integration of Simulators




**DF/2.3 Perform Simulator Integration**

**Figure 3-13**

### 3.1.4.2.3.1 Integrate PTC Simulators

The Integrate PTC Simulators function provides the capability to integrate and test SCS developed payload simulators. These are simulators that completed the entire development process within the SCS including requirements analysis, design, implementation, unit testing, etc. This function allows for integration and testing of groups of payload simulators together as opposed to the unit testing that occurred during the development process.

Inputs
a. TRP_IPS_Tools_Rules_Procedures
b. USER_IPS_User_Inputs
c. SSE_IPS_Flight_Software
d. PSD_IPS_Test_Pro_&_Req
e. PSD_IPS_Test_Plans
f. PSD_IPS_SCS_Developed_Sim

Outputs
a. IPS_FIS_Simulations
b. IPS_USER_Responses_To_User
c. IPS_PSD_Test_Results

3.1.4.2.3.1.1 The Integrate PTC Simulators function shall provide the capability to execute an integrated increment of SCS developed simulators, subsystem simulators, and payload support systems.

3.1.4.2.3.1.2 The Integrate PTC Simulators function shall provide the capability to allow integration of SCS developed simulators with no impact on planned training sessions in the PTC.

3.1.4.2.3.1.3 The Integrate PTC Simulators function shall provide the capability to integrate simulators across all configurations.

### 3.1.4.2.3.2 Integrate Externally Developed Simulators

The Integrate Externally Developed Simulators function provides the capability to integrate and test externally developed payload simulators. These are simulators that were developed by an external source such as PIs.and have not been through the SCS development process.

Inputs
a. PD_IES_Payload_Simulators
b. SSE_IES_Flight_Software
c. TRP_IES_Tools_Rules_Procedures
d. USER_IES_User_Inputs
e. SSE_IES_System_Simulations
f. PSD_IES_Test_Plans
g. PSD_IES_Test_Pro_&_Req

Outputs
a. IES_USER_Responses_To_User
b. IES_FIS_Simulations
c. IES_PSD_Test_Results

3.1.4.2.3.2.1 The Integrate External Simulators function shall provide the capability to verify interfaces defined by SCS simulator interface definitions and standards.

3.1.4.2.3.2.2 The Integrate External Simulators function shall provide the capability to execute an increment of external simulators, subsystem simulators, and payload support systems.

3.1.4.2.3.2.3 The Integrate External Simulators function shall provide the capability to allow integration of simulators with no impact on planned training sessions in the PTC.

3.1.4.2.3.2.4 The Integrate External Simulators function shall provide the capability to integrate simulators across all configurations.

3.1.4.2.3.2.5 The Integrate External Simulators function shall provide the capability for testing and integration of flight equivalent payload hardware and software.

### 3.1.4.2.3.3 Final Integration of Simulators

The Final Integration of Simulators function provides the capability to perform integration testing of internally and externally developed simulators using the operational PTC. After this phase of testing, the simulators are ready for training utilization within the PTC.

Inputs
a. IPS_FIS_Simulations
b. SSE_FIS_Flight_Software
c. IES_FIS_Simulations
d. USER_FIS_User_Inputs
e. TRP_FIS_Tools_Rules_Procedures
f. PSD_FIS_Test_Pro_&_Req
g. PSD_FIS_Test_Plans

Outputs
a. FIS_USER_Responses_To_User
b. FIS_SIML_Simulations
c. FIS_PSD_Test_Results

3.1.4.2.3.3.1 The Perform Final Integration of Simulators function shall provide the capability for integrated increment simulator acceptance testing.

3.1.4.2.3.3.2 The Perform Final Integration of Simulators function shall provide the capability for acceptance testing across all configurations.

### 3.1.4.3 Operations Evaluation Functions

The Operations Evaluation Functions allow for several innovative concepts in present and future operations of the PTC. Figure 3-14 DF/3 shows the SCS operations evaluation functions and the associated data flows. The operations evaluation functions are as follows:

1. Operations Concepts Definition - Development and evaluation of payload operational concepts and rapid prototyping. This function is restricted to on-board operations.

2. Crew Procedures Development/Testing - Development and testing of payload crew operations procedures. Also, analyzes crew procedure execution results.

3. Operations Centers Procedures Development/Testing - Support the development and testing of payload ground operations center procedures. Also, analyzes ground operations center procedure execution results.

4. Timeline Verification - Execution, testing, and verification of payload control timelines. Also, analyzes payload control timeline execution results

5. Demonstrate/Evaluate Space Station Technologies - Demonstration and evaluation of emerging Space Station technologies.

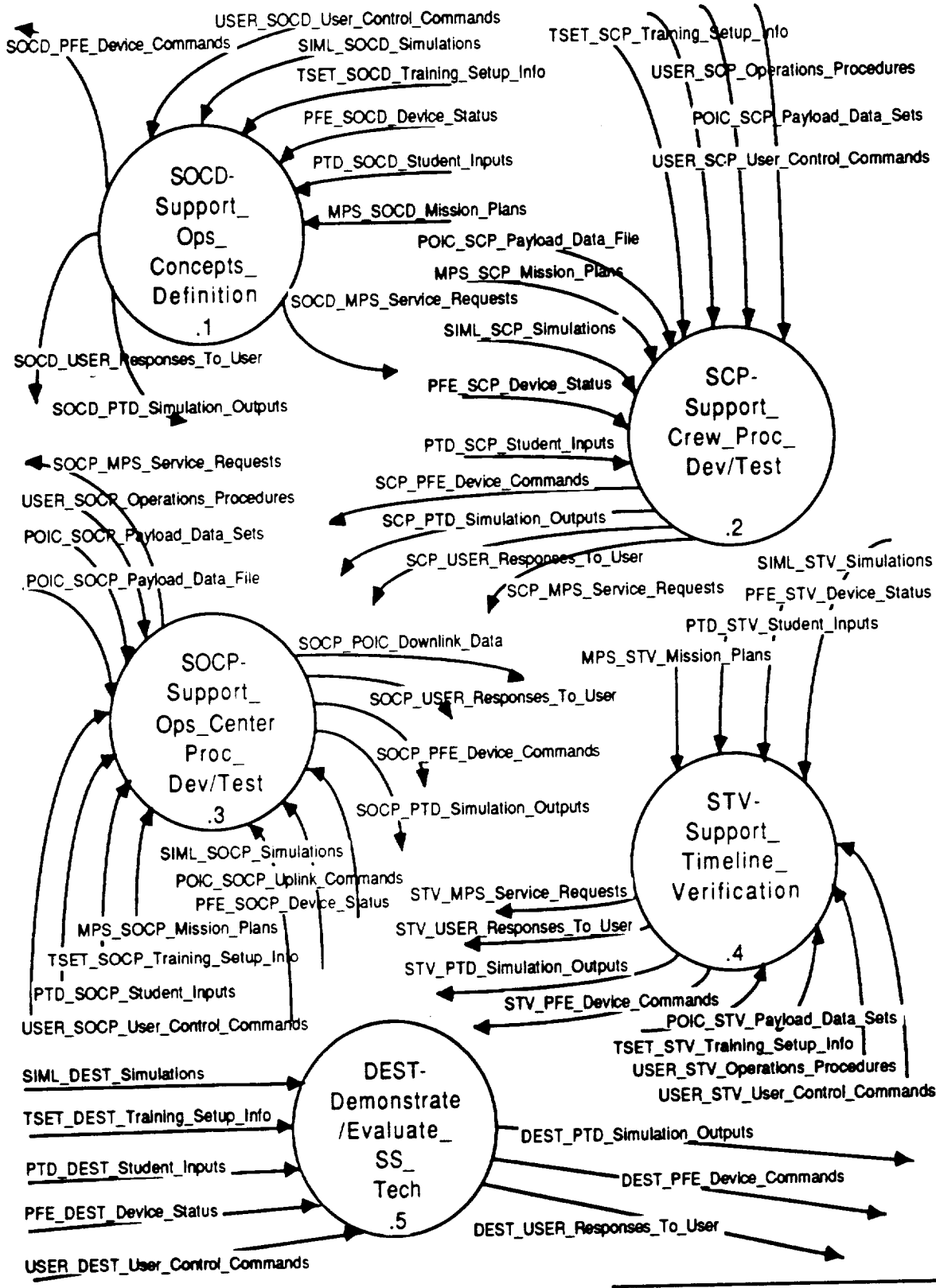
#### 3.1.4.3.1 Operation Concept Definitions

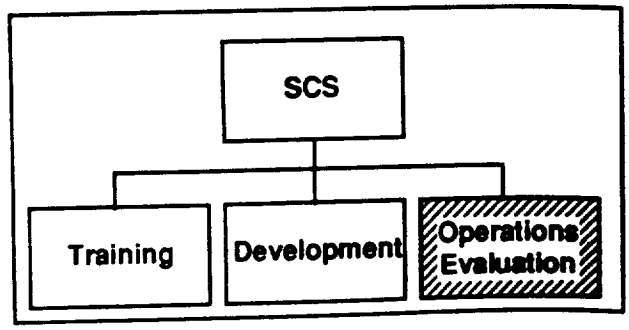
Inputs
a. USER_SOCD_User_Control_Commands
b. SIML_SOCD_Simulations
c. TSET_SOCD_Training_Setup_Info
d. PFE_SOCD_Device_Status
e. PTD_SOCD_Student_Inputs
f. MPS_SOCD_Mission_Plans

Outputs
a. SOCD_USER_Responses_To_User
b. SOCD_PTD_Simulation_Outputs
c. SOCD_PFE_Device_Commands
d. SOCD_MPS_Service_Requests

3.1.4.3.1.1 The Support Operational Concepts Definition function shall provide capabilities for rapid prototyping of payload operator control computer interfaces.

3.1.4.3.1.2 The Support Operational Concepts Definition function shall provide capabilities for rapid prototyping of payload control and display panels.




**DF/3 Perform Operations Evaluation Functions**

**Figure 3-14**

3.1.4.3.1.3 The Support Operational Concepts Definition function shall provide capabilities for rapid prototyping of payload simulators that are interoperable with prototype control interfaces.

3.1.4.3.1.4 The Support Operational Concepts Definition function shall provide the capability to integrate and operate prototypes with operational increment configurations.

### 3.1.4.3.2 Crew Procedures Development/Testing

Inputs
a. TSET_SCP_Training_Setup_Info
b. USER_SCP_Operations_Procedures
c. POIC_SCP_Payload_Data_Sets
d. USER_SCP_User_Control_Commands
e. SIML_SCP_Simulations
f. PFE_SCP_Device_Status
g. PTD_SCP_Student_Inputs
h. POIC_SCP_Payload_Data_File
i. MPS_SCP_Mission_Plans

Outputs
a. SCP_PFE_Device_Commands
b. SCP_PTD_Simulation_Outputs
c. SCP_USER_Responses_To_User
d. SCP_MPS_Service_Requests

3.1.4.3.2.1 The Support Crew Procedures Development/Testing function shall support the development and testing of payload crew operations procedures.

3.1.4.3.2.2 The Support Crew Procedures Development/Testing function shall support the operation of payload simulators of sufficient fidelity to verify payload crew operations procedures.

3.1.4.3.2.3 The Support Crew Procedures Development/Testing function shall provide capabilities for post-test analysis of crew procedure execution results including procedure timing parameters and execution errors.

3.1.4.3.2.4 The Support Crew Procedures Development/Testing function shall provide the capability to execute crew procedures automatically.

### 3.1.4.3.3 Operations Centers Procedures

Inputs
a. USER_SOCP_User_Control_Commands
b. PTD_SOCP_Student_Inputs
c. TSET_SOCP_Training_Setup_Info
d. MPS_SOCP_Mission_Plans
e. PFE_SOCP_Device_Status

f. POIC_SOCP_Uplink_Commands
g. SIML_SOCP_Simulations
h. POIC_SOCP_Payload_Data_File
i. POIC_SOCP_Payload_Data_Sets
j. USER_SOCP_Operations_Procedures

Outputs
a. SOCP_PTD_Simulation_Outputs
b. SOCP_PFE_Device_Commands
c. SOCP_USER_Responses_To_User
d. SOCP_POIC_Downlink_Data
e. SOCP_MPS_Service_Requests

3.1.4.3.3.1 The Support Operations Center Procedure Development/Test function shall support the development and testing of payload ground operations center procedures.

3.1.4.3.3.2 The Support Operations Center Procedure Development/Test function shall support the operation of ground operations facility interface simulators of sufficient fidelity to verify payload ground operations procedures.

3.1.4.3.3.3 The Support Operations Center Procedure Development/Test function shall provide capabilities for post-test analysis of ground operations center procedure execution results including procedure timing parameters and execution errors.

#### 3.1.4.3.4 Timeline Verification

Inputs
a. SIML_STV_Simulations
b. PFE_STV_Device_Status
c. PTD_STV_Student_Inputs
d. MPS_STV_Mission_Plans
e. USER_STV_User_Control_Commands
f. USER_STV_Operations_Procedures
g. TSET_STV_Training_Setup_Info
h. POIC_STV_Payload_Data_Sets

Outputs
a. STV_PTD_Simulation_Outputs
b. STV_PFE_Device_Commands
c. STV_USER_Responses_To_User
d. STV_MPS_Service_Requests

3.1.4.3.4.1 The Support Timeline Verification function shall support the execution, testing, and verification of payload control timelines.

3.1.4.3.4.2 The Support Timeline Verification function shall support the operation of payload simulators of sufficient fidelity to verify payload control timelines.

3.1.4.3.4.3 The Support Timeline Verification function shall provide capabilities for post-test analysis of payload control timeline execution results.

3.1.4.3.4.4 The Support Timeline Verification function shall provide the capability for automated execution of interactive timelines.

#### 3.1.4.3.5 Demonstrate/Evaluate Space Station Technologies

Inputs
a. SIML_DEST_Simulations
b. TSET_DEST_Training_Setup_Info
c. PTD_DEST_Student_Inputs
d. PFE_DEST_Device_Status
e. USER_DEST_User_Control_Commands

Outputs
a. DEST_PTD_Simulation_Outputs
b. DEST_PFE_Device_Commands
c. DEST_USER_Responses_To_User

3.1.4.3.5.1 The Demonstrate/Evaluate SS Technologies function shall support the demonstration and evaluation of SS payload technologies including operator interfaces, data systems, audio/video systems, and advanced software applications.

### 3.1.5 Interface Requirements

#### 3.1.5.1 External Interfaces

Figure 3-2 references all external interfaces to SSF elements. The following describes relational data of these interfaces.

#### 3.1.5.1.1 SSE Interface

3.1.5.1.1.1 To support the Consolidated Increment Trainer function the SCS shall be designed such that it can interface with the SSE System to receive pertinent information such as tools, rules, procedures, system simulations, flight software, and configuration management information.

3.1.5.1.1.2 The SCS shall interface with the SSE System to send simulations and configuration management information.

#### 3.1.5.1.2 SSTF Interface

3.1.5.1.2.1 The SCS shall be designed such that it can support the Consolidated Increment Training function at the SSTF on-site at JSC to receive control commands for a simulation run, subsystem simulation inputs, and C & D panel information during a simulation run.

3.1.5.1.2.2 The SCS shall interface with the SSTF on-site at JSC to transmit simulated payload data, simulation control command responses, and C & D panel information.

#### 3.1.5.1.3 TMIS Interface

3.1.5.1.3.1 The SCS shall interface with TMIS to receive SSF program schedules.

3.1.5.1.3.2 The SCS shall interface with TMIS to send student/trainer records and results collected from any training session.

#### 3.1.5.1.4 POIC Interface

3.1.5.1.4.1 The SCS shall interface with the POIC to receive uplink commands payload data sets, and the payload data file during a simulation run.

3.1.5.1.4.2 The SCS shall interface with the POIC to transmit downlink data during a simulation run.

#### 3.1.5.1.5 MPS Interface

3.1.5.1.5.1 The SCS shall interface with the MPS to receive mission plans specific to an SSF increment.

3.1.5.1.5.2 The SCS shall interface with the MPS to send service requests directed towards the mission plans.

### 3.1.6 Government-Furnished Property List

The SCS system relies on having as GFE:

1. The software DMS system and subsystem models employed by the SSTF and necessary to support payload training.

2. The hardware for the integrated increment and combined trainers including the control and display panels for SSF core systems, for the U.S Lab (2 sets total for 2 US Lab trainers), the Columbus module (2 sets for 2 Columbus trainers), the JEM module (2 sets for 2 JEM trainers), and the attached payload hardware for the attached payloads (1 sets for 1 attached payload trainers).

3. Flight equivalent Element Control Workstations (ECWS) for the consolidated increment , combined trainers, and PTT, for a total of 3 copies of the US Lab ECWS.

4. The hardware from the C&C stations in Node 2 and 3 necessary to support the DMS system such that payload training can be accomplished.

5. DMS Kits as follows:

4 to be shared among 9 part-task trainers

These DMS Kits will each consist of:

1 SIB (Simulation Interface Buffer)
1 Payload Network
1 SDP (Standard Data Processor)
1 FMPAC (Fixed Multi-Purpose Applications Console)
1 Ring Concentrator
2 CMDMs (Control Multiplexer/Demultiplexer)
1 BNIU (Bus Network Interface Unit)
1 TGU (Time Generation Unit)
1 Star Coupler

2 for US Lab trainers (1 each)

The DMS Kit for the US Lab in the Consolidated Increment Trainer will consist of:

1 SIB
1 Payload Network
1 Core Network
3 Local Buses
4 SDPs
2 FMPACs
1 PMPAC (Portable Multi-Purpose Applications Console)
1 MSU (Mass Storage Unit)
1 High Rate Bus and Patch Panel
1 Bridge
6 Ring Concentrator
20 CMDMs
3 BNIUs
1TGU
3 Star Couplers

The DMS Kit for the US Lab in the Combined Trainer will consist of:

1 SIB
1 Payload Network
1 Core Network
2 Local Buses
3 SDPs
1 FMPACs
1 PMPAC
1 MSU
1 High Rate Bus and Patch Panel
1 Bridge
4 Ring Concentrator
12 CMDMs

2 BNIUs
1TGU
2 Star Couplers

1 for the attached payload trainer

The DMS Kit for the Attached Payload Trainer will consist of:

1 SIB
1 Payload Network
1 Core Network
1 Local Buses
2 SDPs
1 FMPAC
1 MSU
1 High Rate Bus and Patch Panel
1 Bridge
2 Ring Concentrator
8 CMDMs
1 BNIU
1TGU
1 Star Coupler

1 for IT&V

The DMS Kit for the IT&V will consist of:

1 SIB
1 Payload Network
1 Core Network
3 Local Buses
4 SDPs
2 FMPACs
1 PMPAC
1 MSU
1 Bridge
6 Ring Concentrator
20 CMDMs
3 BNIUs
1TGU
3 Star Couplers

8 Total DMS Kits will be required for the PTC/SCS

7. ESA Kits (2 sets) equivalent to US Lab DMS Kits, to allow a host computer to drive payload simulations in the Columbus Lab. The ESA Kit consists of:

TBD

8. JEM Kits (2 sets) equivalent to the US Lab DMS Kits to allow a host computer to drive payload simulations in the JEM Lab and the external JEM Payload facility. The JEM Kit consist of:

TBD

From MSFC:

1.The physical facility to house the PTC/SCS system, including the building, with room for the PTC/SCS, offices for the PTC personnel, offices for the simulator developers and maintainers, training class rooms, training carrels, heat, air conditioning, lights, and power appropriate for the facility, hardware, and computers.

## 3.2 System Physical Requirements

### 3.2.1 Performance Characteristics

#### 3.2.1.1 System Performance

3.2.1.1.1 The SCS system shall be capable of supporting training of the flow of trainees as shown in Figure 3-15 simultaneously with the simulator development and operations concept functions necessary to support this same flow. Each increment will consist of 4 to 6 flight crew members and TBD POIC cadre.

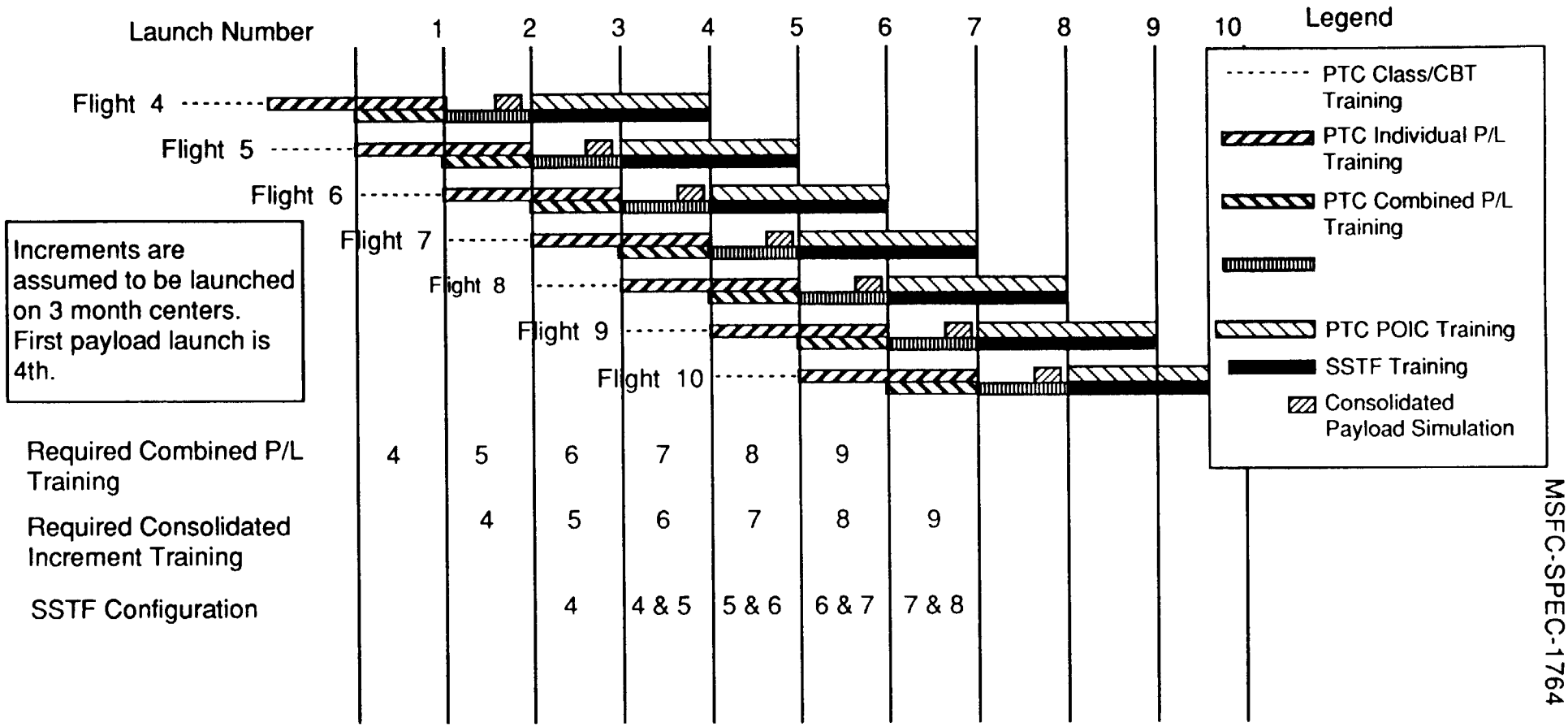
3.2.1.1.2 The SCS system shall be capable of supporting the multiple number of increments simultaneously as shown on Figure 3-15. The consolidated training will be performed on a single increment which changes from one increment to the next every 3 months. The combined training will also be done on a single, but different increment from the consolidated training. All other increments needed for training, simulator development, and simulator maintenance will be maintained on the part-task trainers. The required capacity consists of a consolidated increment training session, 3 combined training sessions, 7 (4 DMS, 3 Non-DMS) part-task training sessions, the development function, the IT&V function, and 6 CBT sessions, all running concurrently. The development facility will be required to support 100 developers.

3.2.1.1.3 The SCS shall be capable of running all core simulations needed for payload training in real time. The purpose of this requirement is to support the non-DMS Part Task Trainers.

3.2.1.1.4 The SCS system response time shall reflect the real time space station environment.

3.2.1.1.4 a The SCS shall be capable of redrawing screens in the trainers at a rate 1Hz.

3.2.1.1.4.b The SCS shall be capable of responding to crew inputs (via keyboard, switch, pushbutton, or hand controller) at a rate of up to 25Hz.

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# PTC Training Increment Flow Requirements

**Figure 3-15**

3.2.1.1.4.c The SCS shall be capable of interfacing to the DMS Kits, which support a payload network running at 10 Megabits per second, a core network running at 10 Megabits per second, and a high rate science data down link through the C&T system operating at 100 Megabits per second.

3.2.1.1.4.d The SCS shall be capable of interfacing to the POIC, and thus to all external elements through the POIC SSIS gateway, at a rate of 100 Megabits per second.

3.2.1.1.4.e The SCS shall be capable of running all payload simulations in real time. It is expected that most of the models will be called once per second for updates, i.e. they will operate at a rate of 1 Hz.

### 3.2.1.2 System reserves

The SCS system shall be delivered with 50% reserve capability in memory, CPU, and mass storage utilization.

### 3.2.1.3 System Security

The SCS shall have as a minimum one layer of software to prevent unauthorized access, including:

a) Unauthorized log on and use of the SCS system.

b) Unauthorized changing of configured software or data.

c) Entry of computer viruses, worms, or Trojan Horses.

## 3.2.2 Physical Characteristics

| This section specifies the following required system physical characteristics: |
|---|
| |
| 1. Weight, dimensional, and volume limits |
| |
| 2. Operator station layout |
| |
| 3. Access for maintenance |
| |
| 4. Security criteria |
| |
| 5. Durability quantitative terms to indicate ruggedness |
| |
| 6. Vulnerability factors, including consideration of radiological operations, electromagnetic radiation, fire, and impact. |
| |
| 7. Transport and storage requirements (for example tiedowns, pallets, packaging, and containers). |

### 3.2.3 Materials, Processing, and Parts

3.2.3.1 Commercially available hardware and software shall be used to the maximum extent possible.

3.2.3.2 Commercially available components that are modified shall be equal or superior to the original in characteristics and quality.

3.2.3.3 All equipment used shall be new and of recent manufacture. Refurbished equipment, materials, and parts shall not be acceptable.

3.2.3.4 Like materials shall be used in the manufacture of similar components.

### 3.2.4 System Control

3.2.4.1 Each training session on a separate increment shall be begun and controlled from a single, separate console or workstation.

3.2.4.2 Beginning a training session shall be simple and straight forward. The operator initiating the session will only have to make selections of items once, and these selection will be made from lists presented with clear, understandable language that makes it clear what is to be selected. The operator will not be forced to enter information which the computer already possesses.

3.2.4.3 Initializing the SCS system shall be accomplished start to system ready in a maximum of 5 minutes.

3.2.4.4 Initializing an individual training session shall be accomplished from start to ready in a maximum of 1 minute.

3.2.4.5 The SCS system shall be designed such that the failure of any hardware or software portion of an individual training session, simulator development, or operations evaluation on a separate increment shall not cause the failure of any other training session, development function, or operations evaluation on other increments.

3.2.4.6 The SCS system shall be designed such that failure of one experiment model in an individual training session shall not cause failure of any other experiment models in that training session.

3.2.4.7 The SCS system shall be designed such that if the computer supporting and individual training, development, or operations evaluations session fails, and another SCS computer is available (not in use), reconfiguration or reconnection can take place and the initialization for the discontinued session can begin 30 minutes from the time the decision was made to reconfigure.

3.2.4.8 The SCS system shall be designed such that during a consolidated payload simulation session, the SCS can be configured for one level of failover. If any SCS component essential to the consolidated payload simulation session fails, that

component can be quickly replaced, and the session resumed. Essential components are defined as any component that would force a halt to the consolidated payload simulation session. Partial failures are allowable, e.g. some payloads, individual DMS EDPs, or individual DMS MDMs. These failures should be recovered in 60 minutes or less.

3.2.4.9 The consolidated payload simulation session failover component replacement shall occur in a maximum of 60 seconds from when the fail over is initiated till when the session can be resumed. If the replacement component fails, a second replacement of that component is not required.

### 3.2.5 Interchangeability

3.2.5.1 The selection and use of interchangeable items shall be in accordance with MIL-STD-454G. This requirement does not apply to commercial off-the-shelf equipment procured and used intact, except that such equipment with the same model and/or part number shall be mechanically and electrically interchangeable.

### 3.2.6 Environment

3.2.6.1 All equipment supplied under this contract shall operate satisfactorily over a temperature range of 15 degrees C to 32 degrees C.

3.2.6.2 All equipment supplied under this contract shall operate satisfactorily over a relative humidity range of 5 percent to 100 percent.

3.2.6.3 All equipment subject to damage in the event of a high ambient temperature excursion shall be adequately protected by included temperature and air flow sensing devices.

3.2.6.3.a These sensing devices shall provide a warning to the operator to shut off the equipment when the ambient temperature rises to within 10% of the temperature that will damage the equipment..

3.2.6.3.b These sensing devices shall operate through suitable power controllers in each cabinet or enclosure to gracefully discontinue operation and automatically remove power before high temperature damage can occur.

No special induced environment, electromagnetic signal environment, magnetic environment, or hostile environment requirements are levied on the SCS system.

### 3.2.7 Electromagnetic Radiation

No special electromagnetic radiation requirements are levied on the SCS system

### 3.2.8 Workmanship

3.2.8.1 The equipment shall be manufactured, assembled, and mounted or installed in a thorough, workmanship-like manner and as specified in MIL-STD-454G. All

components, including the finished equipment, shall be free from any defects which may affect their serviceability or appearance.

3.2.8.2 The principles and criteria of human engineering as specified in MIL-STD-1472C, shall be applied to the development of procedures for operating and maintaining the SCS. No other part of MIL-STD 1472C shall apply to the SCS. The principles and criteria of human engineering as described in the SSE Systems Concept Common User Interface (CUI), and SSIS Human-Computer Interface Guide shall be applied instead to the design of SCS. Commercial equipment need not be modified to meet these requirements, but the degree to which such equipment conforms to human engineering criteria and CUI guidelines shall be a factor in the equipment selection and arrangement within the facility.

### 3.2.9 Safety

The SCS equipment shall be designed and constructed or selected to comply with the appropriate criteria so defined in Requirements 1, 3, and 8 of MIL-STD 454G to provide safe conditions for both personnel and equipment during installation, operation, and maintenance periods.

### 3.2.10 Deployment

The SCS will be part of a single instantiation of the Space Station Payload Training Complex (PTC) to be built and operated at MSFC. It is planned that JSC will purchase and install a copy of the SCS at the SSTF as part of the system.

## 3.3 Computer System Requirements

The subsections below specify requirements pertaining to the computer system requirements in terms of:

1. Computer Resources
2. Programming Standardization
3. System Monitoring

### 3.3.1 Computer Resources

| |
|---|
| This section specifies the following computer system requirements: |
| |
| 1. Instruction set |
| |
| 2. CPU speed in millions of instructions per second (MIPS) for specified instruction mix. |
| |
| 3. Internal computer memory size |
| |
| 4. Word size in bits |

| |
|---|
| 5. Character set standard (for example, ASCII, and EBCDIC) |
| |
| 6. Interrupt capabilities and requirements built into the hardware. |
| |
| 7. Channel number and capacities required |
| |
| 8. Auxiliary storage requirements including tape and disk. |
| |
| 9. Growth capabilities of any part of the computer system. |
| |
| 10. Diagnostic capabilities requirements |
| |
| 11. Additional computer system resource requirements (for example, preprocessing, floating point array processing). |

### 3.3.2 Programming Standardization

This section specifies programming requirements for the CSCIs in the SCS system.

1. The software design and coding standards for the SCS will be those of the Space Station Software System Environment (SSE).

2. Programming Language(s) for the SCS CSCI(s) shall be those approved as part of the SSE. The language used is currently specified as Ada.

3. Compiler/Assembler for the implementation of the SCS CSCI(s) shall be that specified as part of the SSE.

4. SCS CSCI(s) shall be designed using state-of-the-art modular software design techniques.

### 3.3.3 System Monitoring

| This section specifies the following system monitoring requirements: |
|---|
| |
| 1. Dynamic resource monitoring during real-time operations. |
| |
| 2. Functions under operator control |
| |
| 3. Methods of displaying/reporting the use of data |
| |
| 4. Variability of data recording intervals |

## 3.4 Product Assurance

This section discusses system product assurance (SPA) requirements

in terms of:

1. Reliability
2. Maintainability
3. Availability
4. Flexibility and Expansion
5. Transportability
6. Effectiveness Models
7. Safety
8. Quality

### 3.4.1 Reliability

3.4.1.1 The SCS shall be operated 5 days a week, up to 8 hours a day in a fixed site with environmental control consistent with current regulations.

3.4.1.2 The SCS shall behave and perform in a predictable, repeatable and correct fashion.

3.4.1.3 The SCS shall incorporate failure detection and recovery transparent to the user except for any degradation in response time due to diminished resources.

3.4.1.4 The SCS shall maintain a log of detected failures and recovery actions to support SCS administration and maintenance.

3.4.1.5 The reliability of each computer system (host, workstation, and personal computer) and network of the SCS shall equal or exceed 98 percent.

3.4.1.6 The SCS system shall be considered down whenever a component essential to the performance fails.

3.4.1.7 The reliability of the SCS shall be based on the monthly average system uptime ratio. The system uptime ratio is defined as follows:

$$\text{UPTIME RATIO} = 1 + \frac{\text{NDT}}{\text{SRT-SDT}} .$$

Where

SRT is Scheduled Application Run Time

SDT is Scheduled Downtime

NDT is Nonscheduled Downtime

### 3.4.2 Maintainability

3.4.2.1 The SCS system Mean Time Between Failure (MTBF) shall be a minimum of 270 hours.

3.4.2.2 The SCS system Mean Time To Repair (MTTR) for all components shall be a maximum of 8 hours.

3.4.2.3 The SCS shall require a minimum of 8 hours and a maximum of 10 hours of scheduled downtime each week for preventative maintenance.

3.4.2.4 The preventative maintenance, backups, and archiving shall be performed during the hours after scheduled training.

3.4.2.5 The number of people needed to maintain the SCS shall be TBD.

3.4.2.6 The skill level of the people maintaining the SCS shall be:

- high school education with diploma
- trained as an operator in an accredited technical school with diploma

3.4.2.7 The Support equipment required shall include:

- 1 logic analyzer
- 2 multi meters
- 2 complete electronic toolboxes
- TBD other items

### 3.4.3 Availability

3.4.3.1 The SCS system availability shall be defined as follows:

AVAILABILITY = MTBF / (MTBF + MTTR)

Where

MTBF is Mean Time Between Failure
MTTR is Mean Time To Repair

3.4.3.2 The following shall be excluded from availability calculations

a. Time used for computer system or network modification

b. Time spent during nonoperational periods on corrective or preventative maintenance

c. Maintenance time not interfering with scheduled computer system or network functions

d. Downtime during periods of interruption, failure, or out-of-tolerance provision of facility environmental control and services including electrical power, conditioned air, and cooling

3.4.3.3 The SCS computer system and network needed shall be equal to or exceed 95 percent availability.

3.4.3.4 The required values of availability shall be met based on 1600 hours of on-line testing per year per computer system or network. Individual test shall be from 1 to 16 hours in duration.

### 3.4.4 Flexibility and Expansion

3.4.4.1 The SCS shall be able to expand up to 100 percent above the delivered baseline in capacity and capability without a major rework as changes in SSFP requirements occur This applies to memory, mass storage, CPU speed, number of workstations or terminals, and peripherals. For example, it will not be necessary to replace a host computer to double the number of disk drives hooked to that host.

3.4.4.2 The SCS shall be upward compatible such that changes to existing application software are not required when new hardware capabilities are implemented.

3.4.4.3 The SCS shall be upward compatible such that changes to existing hardware are not required when new software capabilities are implemented.

3.4.4.4 The SCS shall be designed in a modular fashion to allow upgrades and enhancements resulting from advanced technologies to be made easily.

### 3.4.5 Equipment Transportability

3.4.5.1 Transportation of the SCS equipment shall be by common carrier.

### 3.4.6 Effectiveness Models

This paragraph is not applicable to this concept document.

### 3.4.7 Safety

3.4.7.1 System safety engineering principles shall be applied throughout the design, development, installation, and test of the SCS in accordance with general requirements of the federal laws.

3.4.7.2 Caution and warning notices shall be prominently displayed on equipment where the risk of injury to operating or maintenance personnel exists.

### 3.4.8 Quality

Verifications of the requirements of Section 3 of this document shall include the use of inspection, analysis, demonstration and test. Verification shall be accomplished during the contractor conducted test program which includes CI/subsystem testing in plant and testing conducted at the PTC.

## 3.5 Logistics Requirements

| This section discusses logistic requirements in terms of: |
|---|
| |
| 1. Maintenance |
| 2. Supply |
| 3. Support Facilities |
| 4. Personnel |
| 5. Training |

### 3.5.1 Maintenance

| This section specifies the maintenance philosophy and requirements in terms of: |
|---|
| |
| 1. Repair versus replacement criteria |
| |
| 2. Organizational levels of maintenance |
| |
| 3. Maintenance cycles |
| |
| 4. Accessibility |
| |
| 5. Uses of multipurpose test equipment |
| |
| 6. Any other maintenance requirements not listed above |

### 3.5.2 Supply

| This section specifies both the requirements the system places on the supply system and the influence of the supply system on system design and use, including: |
|---|
| |
| 1. Re-supply methods |
| |
| 2. Organizational levels of supply control and depots |
| |
| 3. Distribution and location of system stocks |
| |
| 4. Introduction of new items into the supply system |
| |
| 5. Any other supply requirements not listed above |

### 3.5.3 Support Facilities

| This section specifies the support facility requirements in terms of: |
|---|
| |
| 1. Hardware |
| |
| 2. Software |
| |
| 3. Environment control |

#### 3.5.3.1 Hardware

| This section specifies quantitative system requirements for hardware support facilities and equipment in sufficient detail to permit planning of construction or procurement, including: |
|---|
| |
| 1. Number and types of computers |
| |
| 2. Number and types of computer peripherals (for example, terminals, printers, disk drives). |
| |
| 3. Digital test equipment (for example, oscilloscopes, digital probes). |
| |
| 4. Firmware support equipment (for example, Read Only Memory burners). |
| |
| 5. Any other equipment requirements not listed above (for example, built-in Test Equipment). |

#### 3.5.3.2 Software Support

| This section specifies software required for CSCI support during the system's operational life, in sufficient detail to permit planning of construction or procurement, including: |
|---|
| |
| 1. System utilities (for example, diagnostics and system monitors) |
| |
| 2. Software tools (for example, compilers, assemblers, loaders, simulators, debuggers) |
| |
| 3. Planned usage of existing facilities and equipment |

#### 3.5.3.3 Environment Control

| This section describes required environment controls, including: |
|---|
| |
| 1. Space |

| |
|---|
| 2. Power |
| |
| 3. Air conditioning |
| |
| 4. Heat |

### 3.5.4 Personnel

| This section specifies personnel requirements in terms of: |
|---|
| |
| 1. Types and numbers of maintenance crew, both normal and emergency. |
| 2. Types and numbers of personnel to be allocated to the operation and control of the system. |
| |
| 3. Any other personnel requirements not listed above. |
| *It would be good for NASA to spec out the type of people expected to do these functions. It might affect the system design.* |

### 3.5.5 Training

| This section specifies personnel training requirements in terms of: |
|---|
| |
| 1. Contractor and Government responsibility for training personnel on new equipment. |
| *NASA writing this gives NASA the chance to control and specify the division of work.* |
| |
| 2. The training method (for example, school, unit, on-the-job training) for each type of task. |
| |
| 3. Estimates of quantities of equipment to be developed solely for training purposes, including: |
| |
| a. Skills to be developed by devices |
| b. Detailed requirements |
| |
| 4. Training time and locations |
| |
| 5. Quantitative requirements for source material and training aids. |
| |
| 6. Any other training requirements not listed above. |

### 3.6 Precedence

The following is the order or precedence of the concept document relative to documents referenced herein:

a. Concept Document

b. NASA specification or standard

c. Military specification or standard

d. Other contractor specification and standards

## 4.0 QUALIFICATION REQUIREMENTS

This section specifies the system qualification requirements in terms of testing requirements.

### 4.1 Testing Requirements

| |
|---|
| This section discusses the testing requirements to show that the SCS system requirements of Section 3 have been satisfied. |

#### 4.1.1 Verification Methods

| |
|---|
| This system describes the test qualification methods to show that the system |
| requirements have been satisfied (for example, demonstration, |
| inspection) at each life-cycle phase at which system testing takes |
| place (for example, system integration, system installation). |

#### 4.1.2 Responsibility

| |
|---|
| This section assigns responsibility for system performance testing |
| among the contractors, associate contractors, installing activities, and |
| Government agency interaction. |

#### 4.1.3 Location

| |
|---|
| This section specifies the location(s) for performance of tests. |

### 4.2 Formal Test Requirements

| |
|---|
| This section specifies requirements for formal tests/verifications |
| in the following terms: |
| |
| 1.System design characteristics |

| |
|---|
| 2. Performance |
| 3. Operability |
| 4. Environmental testing (for example, shock, vibration, altitude) |
| |
| NOTE:Documentation verification is an integral part of every formal test. |

## 4.3 Qualification Cross Reference Table

This section consists of a Qualification Cross Reference Table that correlates each system requirement in Section 3 to a qualification method, level, and formal test requirement in Section 4.2. Figure 5 of the DID illustrates a sample Qualification Cross Reference Table.

## 5.0 PREPARATION FOR DELIVERY

This section specifies requirements for the preparation of equipment for delivery, including requirements to incorporate non-standard practices.

## 6.0 NOTES

| |
|---|
| This section contains any general information that aids in the understanding of this document. |
| |
| Information in this section is not contractually binding. |

## 7.0 GLOSSARY

This section contains an alphabetic list and definitions of all acronyms used in this document, all proper nouns, and any words used in a non-standard way.

ACD - Architectural Control Document
APSE - Ada Programming Support Environment
ASCII - American Standard Communication Information Interchange
BNIU - Bus Network Interface Unit
CBT - Computer Based Training
CI - Configuration Item
CMDM - Control Multiplexer/Demultiplexer
CPU - Central Processing Unit
CSC - Computer Software Configuration
CSCI - Computer Software Configuration Item
CUI - Common User Interface
DFD - Data Flow Diagram
DID - Data Item Definition
DMS - Data Management System
EBCDIC - Extended Binary-Coded Decimal Interchange Code
ECWS - Element Control Workstation
EDP - Electronic Data Processor
ESA - European Space Agency
FCD - Functional Control Document
FMPAC - Fixed Multi-Purpose Applications Console
GFE - Government Furnished Equipment
GSE - Ground Support Equipment
GSFC - Goddard Space Flight Center
HWCI - Hardware Configuration Item
IT&V - Integration, Test, and Verification
JEM - Japanese Experiment Module
JSC - Johnson Space Center
MDM - Multiplexer/Demultiplexer
MEA - Mass Energy Analysis
MIPS - Millions of Instructions per second
MPAC - Multi-Purpose Application Console
MPS - Mission Planning System
MSFC - Marshall Space Flight Center
MSU - Mass Storage Unit
MTBF - Mean Time Between Failure
MTTR - Mean Time To Repair
NDT - Non-scheduled Downtime
PD - Payload Developers
PFE - Payload Facility Equipment
PI - Principal Investigator
PM Preventive Maintenance
PMMS - Process Materials Management Subsystem
PMPAC - Portable Multi-Purpose Applications Console

POGA - Payload Operations Ground Application
POIC - Payload Operations Integration Center
PTC - Payload Training Center
PTD - PTC Training Devices
SCS - Simulation Computer System
SDP - Standard Data Processor
SDT - Scheduled Downtime
SIB - Simulation Interface Buffer
SPA - System Product Assurance
SRT - Scheduled Application Run Time
SS - Space Station
SSCC - Space Station Control Center
SSE - Software Support Environment
SSF - Space Station Freedom
SSFP - Space Station Freedom Program
SSIS - Space Station Information System
SSP - Space Station Program
SSTF - Space Station Training Facility
TBD - To Be Determined
TGU - Time Generation Unit
TMIS - Technical Management Information System
USE - User Support Environment

# 8.0 APPENDICES

# APPENDIX I
# DATA FLOW ACRONYM LIST

## Acronym List For Data Flow Diagrams

CBT - Computer Based Training
CCD - Perform CBT Courseware Development
COM - Combined Training
CONT - Consolidated Training
CW - Courseware
DEST - Demonstrate/Evaluate SS Technologies
DEV - Perform Development Functions
DI - Design Information
DS - Design Simulator
FIS - Final Integration of Simulators
INTR - SSTF Integrated Training
IPS - Integrate PTC Simulators
IES - Integrate External Simulators
IS - Implement Simulator
MPS - Mission Planning System
OPEV - Perform Operations Evaluation Functions
PCM - Perform Configuration Management
PD - Payload Developers
PFE - PTC Facility Equipment
PM - Perform Maintenance
POIC - Payload Operations Integration Center
POT - Provide Operations Training
PPCT - Perform Payload Crew Training
PPI - Provide POIC Interface
PPOT - Perform POIC Cadre Training
PPPT - Perform PTC Personnel Training
PS - Perform Setup
PSD - Perform Simulator Development
PSF - Perform Support Functions
PSI - Perform Simulator Integration
PSRA - Perform Simulator Requirements Analysis
PTD - PTC Training Devices
PTP - Perform Training Planning
PTRA - Perform Training Results Analysis
PTT - Part-Task/Combined Training
SCP - Support Crew Procedures Development/Testing
SCS - Simulation Computer System
SDS - SCS Developed Simulators
SIML - Simulations
SOCD - Support Operations Concept Definition

## Acronym List For Data Flow Diagrams (continued)

| | |
|---|---|
| SOCP | - Support Operations Centers Procedures Development/Testing |
| SR | - Simulator Requirements |
| SRR | - Student Records/Results |
| SSE | - Software Support Environment System |
| SSTF | - Space Station Training Facility |
| STV | - Support Timeline Verification |
| TD | - Test Documentation |
| TMIS | - Technical Management Information System |
| TP | - Training Plans |
| TRA | - Perform Training Functions |
| TRP | - Tools, Rules, Procedures |
| TS | - Test Simulator |
| TSET | - Training Setup Information |
| USER | - SCS Users |
| WORK | - Support Work-Station Training |

# APPENDIX II
# DATA DICTIONARY

Data Flows:

CBT_PTD_Courseware_Responses = * Any responses from the student during a computer based training session for the payload crew, POIC cadre, or PTC personnel. *

CBT_SRR_Student_Records/Results = * All student records and training results gathered from any one or more training sessions during computer based training. *

CCD_CW_Courseware = * The actual courseware to be utilized during computer based training flowing from the perform CBT courseware development function. *

CCD_USER_Responses_To_User = * Responses from the courseware development support function to the users who include the instructors, developers, and operators. *

COM_PFE_Device_Commands = * Any command necessary to control the PTC facility equipment flowing from the perform combined training function. *

COM_PPOT_Downlink_Data = * The downlink data transmitted to the POIC from the perform combined training function. *

COM_PTD_Simulation_Outputs = * Responses generated by simulators during training sessions from the perform combined training function. *

COM_SRR_Student_Records/Results = * All student records and training results gathered from any one or more training sessions during payload crew combined training. *

COM_USER_Responses_To_User = * Responses from the perform combined training function to the users who include the instructors, developers, and operators. *

CONT_INTR_C_&_D_Panel_Info = * Any feedback from control and display panels from consolidated training to integrated training. *

CONT_INTR_Simulated_Payload_Data = * Simulated payload data that emits from the consolidated training function to the integrated training function. *

CONT_INTR_Sim_Command_Responses = * Any responses to simulation control commands generated during an integrated training session with the SSTF flowing from the consolidated training function to the integrated training function. *

CONT_PFE_Device_Commands = * Any command necessary to control the PTC facility equipment flowing from the perform consolidated training function. *

CONT_PPOT_Downlink_Data = * The downlink data transmitted to the POIC from the perform consolidated training function. *



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OF POOR QUALITY

CONT_PTD_Simulation_Outputs = * Responses generated by simulators during training sessions from the perform consolidated training function. *

CONT_SRR_Student_Records/Results = * All student records and training results gathered from any one or more training sessions during payload crew consolidated training. *

CONT_USER_Responses_To_User = * Responses from the perform consolidated training function to the users who include the instructors, developers, and operators. *

CW_CBT_Courseware = * The actual courseware to be utilized for computer based training for the payload crew, POIC cadre, and PTC personnel flowing from the data store courseware. *

CW_TRA_Courseware = CW_CBT_Courseware * The actual courseware to be utilized for computer based training for all training functions flowing from the data store courseware. *

DEST_PFE_Device_Commands = * Any command necessary to control the PTC facility equipment flowing from the demonstrate/evaluate SS technology function. *

DEST_PTD_Simulation_Outputs = * Responses generated by simulators during training sessions from the demonstrate/evaluate SS technology function. *

DEST_USER_Responses_To_User = * Responses from the demonstrate/evaluate SS technology function to the users who include the instructors, developers, and operators. *

DEV_CW_Courseware = PSF_CW_Courseware * The actual courseware to be utilized for computer based training flowing from the perform development function. *

DEV_MPS_Service_Requests = PSF_MPS_Service_Requests * Any requests of data from the Mission Planning System from the perform development function. *

DEV_SIML_Simulations = PSD_SIML_Updated_Simulators+PSI_SIML_Simulations * All payload simulators, subsystem simulators and related information required for operation of the SCS flowing from the perform development function. *

DEV_SSE_Simulations = PSD_SSE_Simulations * All payload simulators, subsystem simulators, and related information required for operation of the SCS flowing to the SSE. *

DEV_SSE_Status_Info = PSD_SSE_Status_Info * Any information needed by the SSE such as configuration management information flowing from the perform development function. *

DEV_TMIS_Student_Records/Results = PSF_TMIS_Training_Results_Analysis * All student records and training results gathered from any one or more training sessions flowing from the development function to TMIS. *



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DEV_TSET_Training_Setup_Info = PSF_TSET_Training_Config+PSF_TSET_Training_Scenario+PSF_TSET_Training_Script * Any information needed for initialization for the trainer such as training configuration and scenarios flowing from the perform development function. *

DEV_USER_Responses_To_User = PSF_USER_Responses_To_User+PSD_USER_Responses_To_User+PSI_USER_Responses_To_User * Responses from the perform development function to the users who include the instructors, developers, and operators. *

DI_IS_Design_Info = * Simulator design information flowing to the implement simulator function. *

DI_PCM_Design_Info = * Simulator design information flowing to the perform configuration management function. *

DS_DI_Design_Info = * Simulator design information flowing from the design-simulator function. *

DS_TD_Test_Pro_&_Req = * The actual procedures for testing and requirements to be met for a simulator flowing from the design simulator function. *

DS_USER_Responses_To_User = * Any feedback from the users who include the instructors, developers, and operators flowing from the design simulator function. *

FIS_PSD_Test_Results = * The results of the testing of a simulator in report form flowing from the final integration of simulators function. *

FIS_SIML_Simulations = * Payload simulations from the final integration of simulators function. *

FIS_USER_Responses_To_User = * Responses from the final integration of simulators function to the users who include the instructors, developers, and operators. *

IES_FIS_Simulations = * Payload simulations that were developed externally and have been integrated with the SCS. *

IES_PSD_Test_Results = * The results of the testing of a simulator in report form flowing from the integrate external simulators function. *

IES_USER_Responses_To_User = * Responses from the integrate external simulators function to the users who include the instructors, developers, and operators. *

INTR_CONT_C_&_D_Panel_Info = * Any feedback from control and display panels from integrated training to consolidated payload training. *

INTR_CONT_Simulation_Control_Commands = * All commands necessary to operate payload simulations during an integrated training session with SSTF flowing to the perform consolidated training function. *

INTR_CONT_Subsystem_Simulation_Inputs = * Any data needed for subsystem simulation during an integrated training session with the SSTF flowing to the perform consolidated training function. *



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INTR_SSTF_C_&_D_Panel_Info = * Any feedback from control and display panels from integrated mode to the SSTF. *

INTR_SSTF_Simulated_Payload_Data = * Simulated payload data that emits from the integrated training function to the SSTF. *

INTR_SSTF_Sim_Command_Responses = * Any responses to simulation control commands generated during an integrated training session with the SSTF flowing from the integrated training function to the SSTF. *

IPS_FIS_Simulations = * Simulators developed in-house that have been integrated into the SCS. *

IPS_PSD_Test_Results = * The results of the testing of a simulator in report form flowing from the integrate PTC simulators function. *

IPS_USER_Responses_To_User = * Responses from the integrate PTC simulators function to the users who include the instructors, developers, and operators. *

IS_SDS_SCS_Developed_Sim = * Any payload simulators developed using the SCS flowing from the implement simulator function. *

IS_USER_Responses_To_User = * Responses from the implement simulator function to the users who include the instructors, developers, and operators. *

MPS_DEV_Mission_Plans = MPS_PSF_Mission_Plans * Activities necessary to most efficiently utilize the resources of payload missions flowing to the perform development function. *

MPS_OPEV_Mission_Plans = MPS_SCP_Mission_Plans+MPS_SOCP_Mission_Plans+MPS_SOCD_Mission_Plans+MPS_STV_Mission_Plans * Activities necessary to most efficiently utilize the resources of payload missions flowing to perform ops eval func. *

MPS_PSF_Mission_Plans = MPS_PS_Mission_Plans+MPS_PTP_Mission_Plans * Activities necessary to most efficiently utilize the resources of payload missions flowing to the perform support function. *

MPS_PS_Mission_Plans = * Activities necessary to most efficiently utilize the resources of payload missions flowing to the perform setup function. *

MPS_PTP_Mission_Plans = * Activities necessary to most efficiently utilize the resources of payload missions flowing to the perform training planning function. *

MPS_SCP_Mission_Plans = * Activities necessary to most efficiently utilize the resources of payload missions flowing to the support crew procedures dev/test function. *

MPS_SCS_Mission_Plans = MPS_DEV_Mission_Plans+MPS_OPEV_Mission_Plans * Activities necessary to most efficiently utilize the resources of payload missions flowing to the SCS. *

MPS_SOCD_Mission_Plans = * Activities necessary to most efficiently



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utilize the resources of payload missions flowing to the support operations concept definition function. *

MPS_SOCP_Mission_Plans = * Activities necessary to most efficiently utilize the resources of payload missions flowing to the support operations centers procedures dev/test function. *

MPS_STV_Mission_Plans = * Activities necessary to most efficiently utilize the resources of payload missions flowing to the support timeline validation function. *

OPEV_MPS_Service_Requests = SCP_MPS_Service_Requests+SOCP_MPS_Service_Requests+SOCD_MPS_Service_Requests+STV_MPS_Service_Requests * Any requests of data from the Mission Planning System flowing from the perform operations evaluation func. *

OPEV_PFE_Device_Commands = DEST_PFE_Device_Commands+SCP_PFE_Device_Commands+SOCP_PFE_Device_Commands+SOCD_PFE_Device_Commands+STV_PFE_Device_Commands * Any command necessary to control the PTC facility equipment flowing from ops eval. *

OPEV_POIC_Downlink_Data = SOCP_POIC_Downlink_Data * The downlink data transmitted to the POIC from the perform operations evaluation function. *

OPEV_PTD_Simulation_Outputs = DEST_PTD_Simulation_Outputs+SCP_PTD_Simulation_Outputs+SOCP_PTD_Simulation_Outputs+SOCD_PTD_Simulation_Outputs+STV_PTD_Simulation_Outputs * Responses generated by simulators during training sessions from ops ev. *

OPEV_USER_Responses_To_User = DEST_USER_Responses_To_User+SCP_USER_Responses_To_User+SOCP_USER_Responses_To_User+SOCD_USER_Responses_To_User+STV_USER_Responses_To_User * Responses from the ops eval function to the users. *

PCM_PM_Change_Authorize = * A change authorization prompted by a change request from the maintenance function. This occurs when a problem or need exists to change the functionality of a specific simulator (i.e. SPRs, CRs, etc.). *

PCM_SSE_Status_Info = * Any information needed by the SSE such as configuration management information flowing from the perform configuration management function. *

PCM_USER_Responses_To_User = * Responses from the perform configuration management function to the users who include the instructors, developers, and operators. *

PD_DEV_Payload_Simulators = PD_PSI_Payload_Simulators * Any simulator provided by an external source flowing to the perform development function. *

PD_IES_Payload_Simulators = * Any simulator provided by an external source flowing to the integrate external simulators function. *



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PD_PSI_Payload_Simulators = PD_IES_Payload_Simulators * Any simulator provided by an external source flowing to the perform simulator integration function. *

PD_SCS_Payload_Simulators = PD_DEV_Payload_Simulators * Any simulator provided by an external source flowing to the SCS. *

PFE_COM_Device_Status = * The current status of any PTC facility equipment flowing to the perform combined training function. *

PFE_CONT_Device_Status = * The current status of any PTC facility equipment flowing to the perform consolidated training function. *

PFE_DEST_Device_Status = * The current status of any PTC facility equipment flowing to the demonstrate/evaluate SS technology function. *

PFE_OPEV_Device_Status = PFE_DEST_Device_Status+PFE_SCP_Device_Status+PFE_SOCP_Device_Status+PFE_SOCD_Device_Status+PFE_STV_Device_Status * The current status of any PTC facility equipment flowing to the perform ops eval function. *

PFE_PPCT_Device_Status = PFE_CONT_Device_Status+PFE_COM_Device_Status+PFE_PTT_Device_Status * The current status of any PTC facility equipment flowing to the perform payload crew training function. *

PFE_PTT_Device_Status = * The current status of any PTC facility equipment flowing to the perform part-task training function. *

PFE_SCP_Device_Status = * The current status of any PTC facility equipment flowing to the support crew procedures dev/test function. *

PFE_SCS_Device_Status = PFE_TRA_Device_Status+PFE_OPEV_Device_Status * The current status of any PTC facility equipment flowing to the SCS. *

PFE_SOCD_Device_Status = * The current status of any PTC facility equipment flowing to the support operations concept definition function. *

PFE_SOCP_Device_Status = * The current status of any PTC facility equipment flowing to the support operations centers procedures dev/test function. *

PFE_STV_Device_Status = * The current status of any PTC facility equipment flowing to the support timeline validation function. *

PFE_TRA_Device_Status = PFE_PPCT_Device_Status * The current status of any PTC facility equipment flowing to the perform training function. *

PM_PCM_Change_Request = * A change request needed in order to make changes to the functionality of a specific simulator. *

PM_PCM_Update_Info = * Any information needed after an update has been implemented to a simulator. *

PM_SIML_Updated_Simulators = * Simulators that have undergone some sort of changes through the perform maintenance function and are reentering the simulation library. *

PM_USER_Responses_To_User = * Responses from the perform maintenance



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function to the users who include the instructors, developers, and operators. *

POIC_DEV_Payload_Data_File = POIC_PSF_Payload_Data_File * Procedures necessary for operation of the system flowing to the perform development function. *

POIC_OPEV_Payload_Data_File = POIC_SCP_Payload_Data_File+POIC_SOCP_Payload_Data_File * Procedures necessary for operation of the system flowing to the perform operations evaluation function. *

POIC_OPEV_Payload_Data_Sets = POIC_SCP_Payload_Data_Sets+POIC_SOCP_Payload_Data_Sets+POIC_STV_Payload_Data_Sets * Any payload planning info such as short-term plan, target files, payload data files, etc. flowing to the ops eval func. *

POIC_OPEV_Uplink_Commands = POIC_SOCP_Uplink_Commands * All uplink commands received from the POIC flowing to the perform operations evaluation function. *

POIC_PPI_Payload_Data_File = * Procedures necessary for opertion of the system flowing to the provide POIC interface function. *

POIC_PPI_Payload_Data_Sets = * Any payload planning information such as short-term plan, target files, payload data files, etc. flowing to the provide POIC interface function. *

POIC_PPI_Uplink_Commands = * All uplink commands received from the POIC flowing to the provide POIC interface function. *

POIC_PPOT_Payload_Data_File = POIC_PPI_Payload_Data_File+PPI_WORK_Payload_Data_File+PPI_PPOT_Payload_Data_File * Procedures necessary for operation of the system flowing to the perform POIC cadre training. *

POIC_PPOT_Payload_Data_Sets = POIC_PPI_Payload_Data_Sets * Any payload planning information such as short-term plan, target files, payload data files, etc. flowing to the perform POIC cadre training function. *

POIC_PPOT_Uplink_Commands = POIC_PPI_Uplink_Commands * All uplink commands received from the POIC flowing to the perform POIC cadre training function. *

POIC_PSF_Payload_Data_File = POIC_PTP_Payload_Data_File * Procedures necessary for operation of the system flowing to the perform support functions. *

POIC_PTP_Payload_Data_File = * Procedures necessary for operation of the system flowing to the perform training planning function. *

POIC_SCP_Payload_Data_File = * Procedures necessary for operation of the system flowing to the support crew procedures development/testing function. *

POIC_SCP_Payload_Data_Sets = * Any payload planning information such as short-term plan, target files, payload data files, etc., flowing to the support crew procedures dev/test function. *



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POIC_SCS_Payload_Data_File = POIC_TRA_Payload_Data_File+POIC_DEV_Payload_Data_File+POIC_OPEV_Payload_Data_File * Procedures necessary for operation of the system flowing to the SCS. *

POIC_SCS_Payload_Data_Sets = POIC_OPEV_Payload_Data_Sets+POIC_TRA_Payload_Data_Sets * Any payload planning information such as short-term plan, target files, payload data files, etc. flowing to the SCS. *

POIC_SCS_Uplink_Commands = POIC_OPEV_Uplink_Commands+POIC_TRA_Uplink_Commands * All uplink commands received from the POIC flowing to the SCS. *

POIC_SOCP_Payload_Data_File = * Procedures necessary for operation of the system flowing to the support operations centers procedures development/testing. *

POIC_SOCP_Payload_Data_Sets = * Any payload planning information such as short-term plan, target files, payload data files, etc., flowing to the support operation centers procedures dev/test function. *

POIC_SOCP_Uplink_Commands = * All uplink commands received from the POIC flowing to the support operations centers procedures dev/test function. *

POIC_STV_Payload_Data_Sets = * Any payload planning information such as short-term plan, target files, payload data files, etc., flowing to the support timeline validation function. *

POIC_TRA_Payload_Data_File = POIC_PPOT_Payload_Data_File * Procedures necessary for operation of the system flowing to the perform training function. *

POIC_TRA_Payload_Data_Sets = POIC_PPOT_Payload_Data_Sets * Any payload planning information such as short-term plan, target files, payload data files, etc. flowing to the perform training function. *

POIC_TRA_Uplink_Commands = POIC_PPOT_Uplink_Commands * All uplink commands received from the POIC flowing to the perform training function. *

PPCT_PFE_Device_Commands = CONT_PFE_Device_Commands+PTT_PFE_Device_Commands+COM_PFE_Device_Commands * Any command necessary to control the PTC facility equipment flowing from the perform payload crew training function. *

PPCT_PPI_Downlink_Data = * The downlink data transmitted to the POIC from the perform payload crew training function. *

PPCT_PPOT_Downlink_Data = CONT_PPOT_Downlink_Data+PPCT_PPI_Downlink_Data+PTT_PPOT_Downlink_Data+COM_PPOT_Downlink_Data * The downlink data transmitted to the POIC from the perform payload crew training function. *

PPCT_PTD_Simulation_Outputs = CONT_PTD_Simulation_Outputs+PTT_PTD_Simulation_Outputs+COM_PTD_Simulation_Outputs * Responses generated by simulators during training sessions from the perform payload crew training function. *



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PPCT_SRR_Student_Records/Results = CONT_SRR_Student_Records/Results+PTT_SRR_Student_Records/Results+COM_SRR_Student_Records/Results * All student records and training results gathered from any one or more training sessions during payload crew tr. *

PPCT_SSTF_C_&_D_Panel_Info = INTR_SSTF_C_&_D_Panel_Info * Any feedback from control and display panels from the perform payload crew training function. *

PPCT_SSTF_Simulated_Payload_Data = INTR_SSTF_Simulated_Payload_Data * Simulated payload data that emits from the perform payload crew training function to the SSTF. *

PPCT_SSTF_Sim_Command_Responses = INTR_SSTF_Sim_Command_Responses * Any responses to simulation control commands generated during an integrated training session with the SSTF flowing from the perform payload crew training function. *

PPCT_USER_Responses_To_User = CONT_USER_Responses_To_User+PTT_USER_Responses_To_User+COM_USER_Responses_To_User * Responses from the perform payload crew training function to the users who include the instructors, developers, and operators. *

PPI_POIC_Downlink_Data = * The downlink data transmitted to the POIC from the provide POIC interface function. *

PPI_PPCT_Payload_Data_File = * Procedures necessary for the operation of the system flowing to the perform payload crew training function. *

PPI_PPCT_Payload_Data_Sets = * Any payload planning information such as short-term plan, target files, payload data files, etc. flowing to the perform payload crew training function. *

PPI_PPCT_Uplink_Commands = * All uplink commands received from the POIC flowing to the perform payload crew training function. *

PPI_USER_Responses_To_User = * Responses from the provide POIC interface function to the users who include the instructors, developers, and operators. *

PPI_WORK_Downlink_Data = * The downlink data transmitted to the POIC being transmitted to the support work-station training function. *

PPI_WORK_Payload_Data_File = * Procedures necessary for operation of the system flowing to the support work-station training function. *

PPOT_COM_Payload_Data_File = * Procedures necessary for operation of the system flowing to the perform combined training function. *

PPOT_COM_Payload_Data_Sets = * Any payload planning information such as short-term plan, target files, payload data files, etc., flowing to the perform combined training function. *

PPOT_COM_Uplink_Commands = * All uplink commands received from the POIC flowing to the perform combined training function. *

PPOT_CONT_Payload_Data_File = * Procedures necessary for operation of the



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system flowing to the perform consolidated training function. *
PPOT_CONT_Payload_Data_Sets = * Any payload planning information such as short-term plan, target files, payload data files, etc., flowing to the perform consolidated training function. *
PPOT_CONT_Uplink_Commands = * All uplink commands received from the POIC flowing to the perform consolidated training function. *
PPOT_POIC_Downlink_Data = PPI_POIC_Downlink_Data * The downlink data transmitted to the POIC from the perform POIC cadre training. *
PPOT_PPCT_Payload_Data_File = PPOT_PTT_Payload_Data_File+PPOT_COM_Payload_Data_File+PPOT_CONT_Payload_Data_File+PPI_PPCT_Payload_Data_File * Procedures necessary for operation of the system flowing to the perform payload crew training function. *
PPOT_PPCT_Payload_Data_Sets = PPOT_CONT_Payload_Data_Sets+PPOT_PTT_Payload_Data_Sets+PPI_PPCT_Payload_Data_Sets+PPOT_COM_Payload_Data_Sets * Any payload planning information such as short-term plan, target files, payload data files, etc. flowing to crew training func. *
PPOT_PPCT_Uplink_Commands = PPOT_CONT_Uplink_Commands+PPOT_PTT_Uplink_Commands+PPI_PPCT_Uplink_Commands+PPOT_COM_Uplink_Commands * All uplink commands received from the POIC flowing to the perform payload crew training function. *
PPOT_PTT_Payload_Data_File = * Procedures necessary for operation of the system flowing to the perform part-task training function. *
PPOT_PTT_Payload_Data_Sets = * Any payload planning information such as short-term plan, target files, payload data files, etc., flowing to the perform part-task training function. *
PPOT_PTT_Uplink_Commands = * All uplink commands received from the POIC flowing to the perform part-task training function. *
PPOT_SRR_Student_Records/Results = WORK_SRR_Student_Records/Results * All student records and training results gathered from any one or more training sessions during POIC cadre training. *
PPOT_USER_Responses_To_User = WORK_USER_Responses_To_User+PPI_USER_Responses_To_User * Responses from the perform POIC cadre training function to the users who include the instructors, developers, and operators. *
PPPT_PTD_Simulation_Outputs = * Responses generated by simulators during training sessions from the perform PTC personnel training. *
PPPT_USER_Responses_To_User = * Responses from the perform PTC personnel training function to the users who include the instructors, developers, and operators. *
PSD_FIS_Test_Plans = * A general plan of what procedures and documentation are necessary to test a simulator flowing to the final integration of simulators function. *
PSD_FIS_Test_Pro_&_Req = * The actual procedures for testing and



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requirements to be met for a simulator flowing to the final integration of simulators function. *

PSD_IES_Test_Plans = * A general plan of what procedures and documentation are necessary to test a simulator flowing to the integrate external simulators function. *

PSD_IES_Test_Pro_&_Req = * The actual procedures for testing and requirements to be met for a simulator flowing to the integrate external simulators function. *

PSD_IPS_SCS_Developed_Sim = * Any payload simulators developed using the SCS flowing to the integrate PTC simulators function. *

PSD_IPS_Test_Plans = * A general plan of what procedures and documentation are necessary to test a simulator flowing to the integrate PTC simulators function. *

PSD_IPS_Test_Pro_&_Req = * The actual procedures for testing and requirements to be met for a simulator flowing to the integrate PTC simulators function. *

PSD_PSI_SCS_Developed_Sim = PSD_IPS_SCS_Developed_Sim+TS_PSI_SCS_Developed_Sim * Any payload simulators developed using the SCS flowing to the perform simulator integration function. *

PSD_PSI_Test_Documentation = TD_PSI_Test_Documentation+PSD_IPS_Test_Pro_&_Req+PSD_IPS_Test_Plans+PSD_IES_Test_Pro_&_Req+PSD_IES_Test_Plans+PSD_FIS_Test_Pro_&_Req+PSD_FIS_Test_Plans * The culmination of all data needed to perform testing and validation for a sim. *

PSD_SIML_Updated_Simulators = PM_SIML_Updated_Simulators * Simulators that have undergone some sort of changes through the maintenance function and are now flowing from the perform simulator dev function to the sim library. *

PSD_SSE_Simulations = TS_SSE_Simulations * Simulators that are going to the SSE from the perform simulator development function. *

PSD_SSE_Status_Info = PCM_SSE_Status_Info * Any information needed by the SSE such as configuration management information flowing from the perform simulator development function. *

PSD_USER_Responses_To_User = DS_USER_Responses_To_User+IS_USER_Responses_To_User+PCM_USER_Responses_To_User+PM_USER_Responses_To_User+PSRA_USER_Responses_To_User+TS_USER_Responses_To_User * Responses from the perform sim development function to the users. *

PSF_CW_Courseware = CCD_CW_Courseware * The actual courseware to be utilized during computer based training flowing from the perform CBT courseware development function. *

PSF_MPS_Service_Requests = PTP_MPS_Service_Requests * Any requests of data from the Mission Planning System from the perform support function. *

PSF_TMIS_Training_Results_Analysis = PTRA_TMIS_Training_Results_Analysis *



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All training results analyses flowing to TMIS from the perform support function. *

PSF_TP_Training_Plans = PTP_TP_Training_Plans * Training plans that are a basis for training configuration operation flowing to the training planning data store. These do not include the schedules for training. *

PSF_TSET_Training_Config = PS_TSET_Training_Config * Information needed to setup for a particular training configuration flowing from the perform support function. *

PSF_TSET_Training_Scenario = PTP_TSET_Training_Scenario * A particular training scenario to be run for a specific training session from the perform support function. *

PSF_TSET_Training_Script = PS_TSET_Training_Script * A particular training script to be run for a specific training session from perform support functions. *

PSF_USER_Responses_To_User = CCD_USER_Responses_To_User+PS_USER_Responses_To_User+PTP_USER_Responses_To_User+PTRA_USER_Responses_To_User * Responses from the courseware development perform support function to the users. *

PSI_PSD_Test_Results = PSI_TD_Test_Results+IPS_PSD_Test_Results+IES_PSD_Test_Results+FIS_PSD_Test_Results * The results of the testing of a simulator in report form flowing from the perform simulator integration function. *

PSI_SIML_Simulations = FIS_SIML_Simulations * Simulators after integration flowing to the simulation library. *

PSI_TD_Test_Results = * The results of the testing of a simulator in report form flowing to the test documentation store. *

PSI_USER_Responses_To_User = FIS_USER_Responses_To_User+IPS_USER_Responses_To_User+IES_USER_Responses_To_User * Responses from the perform simulator integration function to the users who include the instructors, developers, and operators. *

PSRA_SR_Simulator_Req = * Simulator requirements information. *

PSRA_TD_Test_Plans = * A general plan of what procedures and documentation are necessary to test a simulator flowing from the perform simulator requirements analysis. *

PSRA_USER_Responses_To_User = * Responses from the perform simulator requirements analysis function to the users who include the instructors, developers, and operators. This data includes a simulator requirements analysis report. *

PS_TSET_Training_Config = * Information needed to setup for a particular training configuration flowing from the perform setup function. *

PS_TSET_Training_Script = * A particular training script to be run for a specific training session from the perform setup function. *



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Data Flows:

PS_USER_Responses_To_User = * Responses from the perform setup function to the users who include the instructors, developers, and operators. *

PTD_CBT_Student_Inputs = * Any inputs from the student flowing to the perform computer based training function. *

PTD_COM_Student_Inputs = * Any inputs from the student flowing to the perform combined training function. *

PTD_CONT_Student_Inputs = * Any inputs from the student flowing to the perform consolidated training function. *

PTD_DEST_Student_Inputs = * Any inputs from the student flowing to the demonstrate/evaluate SS technology function. *

PTD_OPEV_Student_Inputs = PTD_DEST_Student_Inputs+PTD_SCP_Student_Inputs+PTD_SOCP_Student_Inputs+PTD_SOCD_Student_Inputs+PTD_STV_Student_Inputs * Any inputs from the student flowing to the perform operations evaluation function. *

PTD_PPCT_Student_Inputs = PTD_CONT_Student_Inputs+PTD_PTT_Student_Inputs+PTD_COM_Student_Inputs * Any inputs from the student flowing to the perform payload crew training function. *

PTD_PPPT_Student_Inputs = * Any inputs from the student flowing to the perform PTC personnel training function. *

PTD_PTT_Student_Inputs = * Any inputs from the student flowing to the perform part-task training function. *

PTD_SCP_Student_Inputs = * Any inputs from the student flowing to the support crew procedures dev/test function. *

PTD_SCS_Student_Inputs = PTD_OPEV_Student_Inputs+PTD_TRA_Student_Inputs * Any inputs from the student flowing to the SCS. *

PTD_SOCD_Student_Inputs = * Any inputs from the student flowing to the support operations concept definition function. *

PTD_SOCP_Student_Inputs = * Any inputs from the student flowing to the support operations centers procedures dev/test function. *

PTD_STV_Student_Inputs = * Any inputs from the student flowing to the support timeline validation function. *

PTD_TRA_Student_Inputs = PTD_CBT_Student_Inputs+PTD_PPCT_Student_Inputs+PTD_PPPT_Student_Inputs * Any inputs from the student flowing to the perform training function. *

PTP_MPS_Service_Requests = * Any requests of data from the Mission Planning System from the perform training planning function. *

PTP_TP_Training_Plans = * Training plans that are a basis for training configuration operation flowing to the training plans store. *

PTP_TSET_Training_Scenario = * A particular training scenario to be run



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for a specific training session from the perform training planning function. *

PTP_USER_Responses_To_User = * Responses from the perform training planning function to the users who include the instructors, developers, and operators. This data contains the schedules for training. *

PTRA_TMIS_Training_Results_Analysis = * All training results analyses flowing to TMIS. This data only consists of payload crew and POIC cadre training results. PTC personnel results do not go to TMIS. *

PTRA_USER_Responses_To_User = * Responses from the perform training results analysis to the users who include the instructors, developers, and operators. This data contains the training results analysis for PTC personnel. *

PTT_PFE_Device_Commands = * Any command necessary to control the PTC facility equipment flowing from the perform part-task training function. *

PTT_PPOT_Downlink_Data = * The downlink data transmitted to the POIC from the perform part-task training function. *

PTT_PTD_Simulation_Outputs = * Responses generated by simulators during training sessions from the perform part-task training function. *

PTT_SRR_Student_Records/Results = * All student records and training results gathered from any one or more training sessions during payload crew part-task training. *

PTT_USER_Responses_To_User = * Responses from the perform part-task training function to the users who include the instructors, developers, and operators. *

SCP_MPS_Service_Requests = * Any requests of data from the Mission Planning System from the support crew procedures dev/test function. *

SCP_PFE_Device_Commands = * Any command necessary to control the PTC facility equipment flowing from the support crew procedures dev/test function. *

SCP_PTD_Simulation_Outputs = * Responses operated by simulators during training sessions from the support crew procedures dev/test function. *

SCP_USER_Responses_To_User = * Responses from the support crew procedures dev/test function to the users who include the instructors, developers, and operators. *

SCS_MPS_Service_Requests = DEV_MPS_Service_Requests+OPEV_MPS_Service_Requests * Any requests of data from the Mission Planning System from the SCS. *

SCS_PFE_Device_Commands = OPEV_PFE_Device_Commands+TRA_PFE_Device_Commands * Any command necessary to control the PTC facility equipment flowing from the SCS. *

SCS_POIC_Downlink_Data = OPEV_POIC_Downlink_Data+TRA_POIC_Downlink_Data *



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The downlink data transmitted to the POIC from the SCS. *
SCS_PTD_Simulation_Outputs = OPEV_PTD_Simulation_Outputs+TRA_PTD_Simulation_Outputs * Responses generated by simulators during training sessions from the SCS. *
SCS_SSE_Simulations = DEV_SSE_Simulations * Payload simulators from the SCS flowing to the SSE. *
SCS_SSE_Status_Info = DEV_SSE_Status_Info * Any information needed by the SSE such as configuration management information flowing from the SCS. *
SCS_SSTF_C_&_D_Panel_Info = TRA_SSTF_C_&_D_Panel_Info * Any feedback from control and display panels from the SCS to the SSTF. *
SCS_SSTF_Simulated_Payload_Data = TRA_SSTF_Simulated_Payload_Data * Simulated payload data that emits from the SCS to the SSTF. *
SCS_SSTF_Sim_Command_Responses = TRA_SSTF_Sim_Command_Responses * Any responses to simulation control commands generated during an integrated training session with the SSTF flowing from the SCS. *
SCS_TMIS_Student_Records/Results = DEV_TMIS_Student_Records/Results * All student records and training results gathered from any one or more training sessions flowing from the SCS to TMIS. *
SCS_USER_Responses_To_User = DEV_USER_Responses_To_User+OPEV_USER_Responses_To_User+TRA_USER_Responses_To_User * Responses from the SCS to the users who include the instructors, developers, and operators. *
SDS_PCM_SCS_Developed_Sim = * Any payload simulators developed using the SCS flowing to the perform configuration management function. *
SDS_TS_SCS_Developed_Sim = * Any payload simulators developed using the SCS flowing to the test simulator function. *
SIML_CCD_Simulation_Config = * The simulation configuration needed for a specific training session flowing to the perform CBT courseware development function. *
SIML_COM_Simulations = * Payload simulations flowing to the perform combined training function. *
SIML_CONT_Simulations = * Payload simulations flowing to the perform consolidated training function. *
SIML_DEST_Simulations = * Payload simulations flowing to the demonstrate/evaluate SS technology function. *
SIML_DEV_Simulations = SIML_PSD_Simulations+SIML_PSF_Simulation_Config * Payload simulations to be utilized for testing by the perform development function. *
SIML_INTR_Simulations = * Payload simulations flowing to the perform integrated training function. *
SIML_OPEV_Simulations = SIML_DEST_Simulations+SIML_SCP_Simulations+SIML_SOCP_Simulations+SIML_SOCD_Simulations+SIML_STV_Simulations * Payload simulations needed to perform operations evaluation functions. *

Data Flows:

SIML_PM_Operational_Sim = * All simulators that have been tested and are now operational in the PTC. *

SIML_PPCT_Simulations = SIML_CONT_Simulations+SIML_INTR_Simulations+SIML_PTT_Simulations+SIML_COM_Simulations * All simulations needed for the perform payload crew training function. *

SIML_PPOT_Simulations = SIML_WORK_Simulations * All simulations needed for the perform POIC cadre training function. *

SIML_PSD_Simulations = SIML_PM_Operational_Sim * All simulations needed for the perform simulator development function. *

SIML_PSF_Simulation_Config = SIML_CCD_Simulation_Config+SIML_PS_Simulation_Config * The simulation configuration needed for a specific training session flowing to the perform support function. *

SIML_PS_Simulation_Config = * The simulation configuration needed for a specific training session flowing to the perform setup function. *

SIML_PTT_Simulations = * Payload simulations flowing to the perform part-task training function. *

SIML_SCP_Simulations = * Payload simulations flowing to the support crew procedures dev/test function. *

SIML_SOCD_Simulations = * Payload simulations flowing to the support operations concept definition function. *

SIML_SOCP_Simulations = * Payload simulations flowing to the support operations centers procedures dev/test function. *

SIML_STV_Simulations = * Payload simulations flowing to the support timeline validation function. *

SIML_TRA_Simulations = SIML_PPCT_Simulations+SIML_PPOT_Simulations * Simulations needed by the perform training function. *

SIML_WORK_Simulations = * Payload simulations flowing to the support work-station training function. *

SOCD_MPS_Service_Requests = * Any requests of data from the Mission Planning System from the support operations concept definition function. *

SOCD_PFE_Device_Commands = * Any command necessary to control the PTC facility equipment flowing from the support operations concepts definitions function. *

SOCD_PTD_Simulation_Outputs = * Responses generated by simulators during training sessions from the support operations concept definition function. *

SOCD_USER_Responses_To_User = * Responses from the operations concepts definition function to the users who include the instructors,

developers, and operators. *

SOCP_MPS_Service_Requests = * Any requests of data from the Mission Planning System from the support operations centers procedures dev/test function. *

SOCP_PFE_Device_Commands = * Any command necessary to control the PTC facility equipment flowing from the support operations centers procedures dev/test function. *

SOCP_POIC_Downlink_Data = * The downlink data transmitted to the POIC from the support operations centers procedures dev/test function. *

SOCP_PTD_Simulation_Outputs = * Responses generated by simulators during training sessions from the support operations centers procedures dev/test function. *

SOCP_USER_Responses_To_User = * Responses from the support operations centers procedures dev/test function to the users who include the instructors, developers, and operators. *

SRR_DEV_Student_Records/Results = SRR_PSF_Student_Records/Results * All student records and training results gathered from any one or more training sessions flowing to the perform development function. *

SRR_PSF_Student_Records/Results = SRR_PTRA_Student_Records/Results * All student records and training results gathered from any one or more training sessions flowing to the perform support function. *

SRR_PTRA_Student_Records/Results = * All student records and training results gathered from any one or more training sessions in order to be analyzed for training results. *

SR_DS_Simulator_Req = * Simulator requirements information such as data base requirements and documents flowing to the design simulator function. *

SR_PCM_Simulator_Req = * Simulator requirements information such as data base requirements and documents flowing to the perform configuration management function. *

SR_TS_Simulator_Req = * Simulator requirements information such as data base requirements and documents flowing to the test simulator function. *

SSE_DEV_Flight_Software = SSE_PSD_Flight_Software+SSE_PSI_Flight_Software * The flight software flowing to the perform development function. *

SSE_DEV_Status_Info = SSE_PSD_Status_Info * Any information needed by the SCS such as configuration management information flowing from the SSE. *

SSE_DEV_System_Simulations = SSE_PSI_System_Simulations * All system simulations from the SSE required to support the payload simulators flowing to the perform development function. *

SSE_FIS_Flight_Software = * The flight software flowing to the final integration of simulators function. *

SSE_IES_Flight_Software = * The flight software flowing to the integrate external simulators function. *

SSE_IES_System_Simulations = * All system simulations from the SSE required to support the payload simulators for training flowing to the integrate external simulators function. *

SSE_IPS_Flight_Software = * The flight software flowing to the integrate PTC simulators function. *

SSE_PCM_CM_Info = * Any configuration management information needed from the SSE flowing to the perform configuration management function. *

SSE_PSD_Flight_Software = SSE_TS_Flight_Software * The flight software flowing to the perform simulator development function. *

SSE_PSD_Status_Info = SSE_PCM_CM_Info * Any information needed by the SCS such as configuration management information flowing to the perform simulator development function. *

SSE_PSI_Flight_Software = SSE_FIS_Flight_Software+SSE_IPS_Flight_Software+SSE_IES_Flight_Software * The flight software flowing to the perform simulator integration function. *

SSE_PSI_System_Simulations = SSE_IES_System_Simulations * All system simulations from the SSE required to support the payload simulators flowing to the perform simulator integration function. *

SSE_SCS_Flight_Software = SSE_DEV_Flight_Software * The flight software flowing to the SCS. *

SSE_SCS_Status_Info = SSE_DEV_Status_Info * Any information needed by the SCS such as configuration management information flowing from the SSE. *

SSE_SCS_System_Simulations = SSE_DEV_System_Simulations * All system simulations from the SSE required to support the payload simulators flowing to the SCS. *

SSE_SCS_Tools_Rules_Procedures = SSE_TRP_Tools_Rules_Procedures * All tools, rules, and procedures provided by the SSE to develop and maintain software flowing to the SCS. *

SSE_TRP_Tools_Rules_Procedures = * All tools, rules, and procedures provided by the SSE to develop and maintain software flowing to the perform development function. *

SSE_TS_Flight_Software = * The flight software flowing to the test simulator function. *

SSTF_INTR_C_&_D_Panel_Info = * Any feedback from control and display panels from the SSTF to integrated training. *

SSTF_INTR_Simulation_Control_Commands = * All commands necessary to operate payload simulations during an integrated training session with the SSTF flowing to the integrated training function. *

SSTF_INTR_Subsystem_Simulation_Inputs = * Any data needed for subsystem simulation during an integrated training session with the SSTF flowing

to the integrated training function. *

SSTF_PPCT_C_&_D_Panel_Info = SSTF_INTR_C_&_D_Panel_Info * Any feedback from control and display panels from the SSTF flowing to the perform payload crew training function. *

SSTF_PPCT_Simulation_Control_Commands = SSTF_INTR_Simulation_Control_Commands * All commands necessary to operate payload simulations during an integrated training session with the SSTF flowing to the perform payload crew training function. *

SSTF_PPCT_Subsystem_Simulation_Inputs = SSTF_INTR_Subsystem_Simulation_Inputs * Any data needed for subsystem simulation during an integrated training session with the SSTF flowing to the perform payload crew training function. *

SSTF_SCS_C_&_D_Panel_Info = SSTF_TRA_C_&_D_Panel_Info * Any feedback from control and display panels from the SSTF to the SCS. *

SSTF_SCS_Simulation_Control_Commands = SSTF_TRA_Simulation_Control_Commands * All commands necessary to operate payload simulations during an integrated training session with the SSTF flowing to the SCS. *

SSTF_SCS_Subsystem_Simulation_Inputs = SSTF_TRA_Subsystem_Simulation_Inputs * Any data needed for subsystem simulation during an integrated training session with the SSTF flowing to the SCS. *

SSTF_TRA_C_&_D_Panel_Info = SSTF_PPCT_C_&_D_Panel_Info * Any feedback from control and display panels from the perform training function to the SSTF. *

SSTF_TRA_Simulation_Control_Commands = SSTF_PPCT_Simulation_Control_Commands * All commands necessary to operate payload simulations during an integrated training session with the SSTF flowing to the perform training function. *

SSTF_TRA_Subsystem_Simulation_Inputs = SSTF_PPCT_Subsystem_Simulation_Inputs * Any data needed for subsystem simulation during an integrated training session with the SSTF flowing to the perform training function. *

STV_MPS_Service_Requests = * Any requests of data from the Mission Planning System from the support timeline validation function. *

STV_PFE_Device_Commands = * Any command necessary to control the PTC facility equipment flowing from the support timeline validation function. *

STV_PTD_Simulation_Outputs = * Responses generated by simulators during training sessions from the support timeline validation function. *

STV_USER_Responses_To_User = * Responses from the support timeline validation function to the users who include the instructors, developers, and operators. *

TD_PCM_Test_Documentation = * The test documentation for an SCS developed

payload simulator to be controlled under configuration management. *

TD_PSI_Test_Documentation = * The culmination of all data needed to perform testing and validation for a simulator and also testing results flowing to the perform simulator integration function. *

TD_TS_Test_Documentation = * The culmination of all data needed to perform testing and validation for a simulator and also all testing results flowing to the test simulator function. *

TMIS_DEV_Program_Schedules = TMIS_PSD_Program_Schedules * All information relating to the schedule for mission training flowing to the perform development function. *

TMIS_PCM_Program_Schedules = * All information relating to the schedule for mission training flowing to the perform configuration management function. *

TMIS_PSD_Program_Schedules = TMIS_PCM_Program_Schedules * All information relating to the schedule for mission training flowing to the perform simulator development function. *

TMIS_SCS_Program_Schedules = TMIS_DEV_Program_Schedules * All information relating to the schedule for mission training flowing to the SCS. *

TP_CCD_CBT_Courseware_Req = * CBT courseware requirements contain essential information necessary to build CBT courseware specific to a training session flowing from the training planning function. *

TP_PSD_Training_Plans = TP_PSRA_Training_Plans * Training plans that are a basis for training simulator requirements definition flowing to the perform simulator development function. These do not include the schedules for training. *

TP_PSF_Training_Plans = TP_PS_Training_Scenario+TP_PS_Training_Script_Req+TP_CCD_CBT_Courseware_Req * Training plans that are necessary to complete the setup and CBT courseware development functions such as training scenarios, script req, and courseware req. *

TP_PSRA_Training_Plans = * Training plans contain information essential to the building of simulator requirements such as training scenarios, script requirements, and any other documentation relative to training. *

TP_PS_Training_Scenario = * A particular training scenario to be run for a specific training session from the training planning data store. This scenario is to be utilized for script building. *

TP_PS_Training_Script_Req = * Script requirements contain necessary information to build and determine script functionality that flow from the training planning data store. *

TRA_PFE_Device_Commands = PPCT_PFE_Device_Commands * Any command necessary to control the PTC facility equipment flowing from the perform training function. *

TRA_POIC_Downlink_Data = PPOT_POIC_Downlink_Data * The downlink data

transmitted to the POIC from the perform training function. *

TRA_PTD_Simulation_Outputs = CBT_PTD_Courseware_Responses+PPCT_PTD_Simulation_Outputs+PPPT_PTD_Simulation_Outputs * Responses generated by simulators during training sessions from the perform training function. *

TRA_SRR_Student_Records/Results = CBT_SRR_Student_Records/Results+PPCT_SRR_Student_Records/Results+PPOT_SRR_Student_Records/Results * All student records and training results gathered from any one or more training sessions flowing from the perform training function. *

TRA_SSTF_C_&_D_Panel_Info = PPCT_SSTF_C_&_D_Panel_Info * Any feedback from control and display panels from the perform training function to the SSTF. *

TRA_SSTF_Simulated_Payload_Data = PPCT_SSTF_Simulated_Payload_Data * Simulated payload data that emits from the perform training function to the SSTF. *

TRA_SSTF_Sim_Command_Responses = PPCT_SSTF_Sim_Command_Responses * Any responses to simulation control commands generated during an integrated training session with the SSTF flowing from the perform training function. *

TRA_USER_Responses_To_User = PPCT_USER_Responses_To_User+PPOT_USER_Responses_To_User+PPPT_USER_Responses_To_User * Responses from the perform training function to the users who include the instructors, developers, and operators. *

TRP_DEV_Tools_Rules_Procedures = TRP_PSD_Tools_Rules_Procedures+TRP_PSI_Tools_Rules_Procedures * All tools, rules, and procedures provided by the SSE to develop and maintain software flowing to the perform simulator development function. *

TRP_DS_Design_Tools = * Any specific tools required from the SSE in order to design a simulator. *

TRP_FIS_Tools_Rules_Procedures = * All tools, rules, and procedures provided by the SSE to develop and maintain software flowing to the final integration of simulators function. *

TRP_IES_Tools_Rules_Procedures = * All tools, rules, and procedures provided by the SSE to develop and maintain software flowing to the integrate external simulators function. *

TRP_IPS_Tools_Rules_Procedures = * All tools, rules, and procedures provided by the SSE to develop and maintain software flowing to the integrate PTC simulators function. *

TRP_IS_Imp_Tools = * Any specific tools required from the SSE in order to implement a simulator. *

TRP_IS_Reusable_Products = * Any reusable products from the SSE that will support implementation of a simulator. *

TRP_PCM_CM_Tools = * Any specific tools required from the SSE in order to perform configuration management. *

TRP_PM_Tools_Rules_Procedures = * All tools, rules, and procedures provided by the SSE to develop and maintain software flowing to the perform maintenance function. *

TRP_PSD_Tools_Rules_Procedures = TRP_DS_Design_Tools+TRP_IS_Imp_Tools+TRP_PCM_CM_Tools+TRP_PM_Tools_Rules_Procedures+TRP_PSRA_Req_Tools+TRP_TS_Test_Tools+TRP_IS_Reusable_Products * All tools, rules, and procedures provided by the SSE to develop and maintain software. *

TRP_PSI_Tools_Rules_Procedures = TRP_FIS_Tools_Rules_Procedures+TRP_IPS_Tools_Rules_Procedures+TRP_IES_Tools_Rules_Procedures * All tools, rules, and procedures provided by the SSE to develop and maintain software flowing to sim integration. *

TRP_PSRA_Req_Tools = * Any specific tools required from the SSE in order to build requirements flowing to the perform simulator requirements analysis function. *

TRP_TS_Test_Tools = * Any specific tools required from the SSE in order to support simulator test development and execution. *

TSET_COM_Training_Config = * Information needed to setup for a particular training configuration flowing to the perform combined training function. *

TSET_COM_Training_Scenario = * A particular training scenario to be run for a specific training session flowing to the perform combined training function. *

TSET_CONT_Training_Config = * Information needed to setup for a particular training configuration flowing to the perform consolidated training function. *

TSET_CONT_Training_Scenario = * A particular training scenario to be run for a specific training session flowing to the perform consolidated training function. *

TSET_DEST_Training_Setup_Info = * Any information needed for initialization for the trainer such as training configuration and scenarios flowing to the demonstrate/evaluate SS technology function. *

TSET_DEV_Training_Scenario = TSET_PSF_Training_Scenario * Training scenario to be utilized for training results analysis to gather the expected results. *

TSET_OPEV_Training_Setup_Info = TSET_DEST_Training_Setup_Info+TSET_SCP_Training_Setup_Info+TSET_SOCP_Training_Setup_Info+TSET_SOCD_Training_Setup_Info+TSET_STV_Training_Setup_Info * Any information needed for initialization for the trainer. *

TSET_PPCT_Training_Config = TSET_PTT_Training_Config+TSET_COM_Training_Config+TSET_CONT_Training_Config * Information needed to setup for a

particular training configuration flowing to the perform payload crew training function. *

TSET_PPCT_Training_Scenario = TSET_PTT_Training_Scenario+TSET_COM_Training_Scenario+TSET_CONT_Training_Scenario * A particular training scenario to be run for a specific training session flowing to the perform payload crew training function. *

TSET_PPI_Training_Config = * The training configuration that is necessary to setup the hardware configuration and communication protocol for the POIC interface function. *

TSET_PPOT_Training_Config = TSET_WORK_Training_Config+TSET_PPI_Training_Config * Information needed to setup for a particular training configuration flowing to the perform POIC cadre training function. *

TSET_PPOT_Training_Scenario = TSET_WORK_Training_Scenario * A particular training scenario to be run for a specific training session flowing to the perform POIC cadre training function. *

TSET_PPPT_Training_Config = * Information needed to setup for a particular training configuration flowing to the perform PTC personnel training function. *

TSET_PPPT_Training_Scenario = * A particular training scenario to be run for a specific training session flowing to the perform PTC personnel training function. *

TSET_PSF_Training_Scenario = TSET_PTRA_Training_Scenario * Training scenario to be utilized for expected results data for the perform results analysis function. *

TSET_PTRA_Training_Scenario = * Training scenario to be utilized to obtain expected results for training in order to perform a training results analysis. *

TSET_PTT_Training_Config = * Information needed to setup for a particular training configuration flowing to the perform part-task training function. *

TSET_PTT_Training_Scenario = * A particular training scenario to be run for a specific training session flowing to the perform part-task training function. *

TSET_SCP_Training_Setup_Info = * Any information needed for initialization for the trainer such as training configuration and scenarios flowing to the support crew procedures dev/test function. *

TSET_SOCD_Training_Setup_Info = * Any information needed for initialization for the trainer such as training configuration and scenarios flowing to the support operations concept definition function. *

TSET_SOCP_Training_Setup_Info = * Any information needed for initialization for the trainer such as training configuration and

scenarios flowing to the support operations centers procedures dev/test function. *

TSET_STV_Training_Setup_Info = * Any information needed for initialization for the trainer such as training configuration and scenarios flowing to the support timeline validation function. *

TSET_TRA_Training_Setup_Info = TSET_PPCT_Training_Config+TSET_PPCT_Training_Scenario+TSET_PPOT_Training_Config+TSET_PPOT_Training_Scenario+TSET_PPPT_Training_Config+TSET_PPPT_Training_Scenario * Any information needed for training setup. *

TSET_WORK_Training_Config = * Information needed to setup for a particular training configuration flowing to the support work-station training function. *

TSET_WORK_Training_Scenario = * A particular training scenario to be run for a specific training session flowing to the support work-station training function. *

TS_PSI_SCS_Developed_Sim = * Any payload simulators developed using the SCS flowing from the test simulator function. *

TS_SSE_Simulations = * Payload simulations flowing to the SSE. *

TS_TD_Test_Results = * The results of the testing of a simulator in report form flowing from the test simulator function. *

TS_USER_Responses_To_User = * Responses from the test simulator function to the users who include the instructors, developers, and operators. *

USER_CCD_User_Inputs = * Any information from the users who include instructors, developers, and operators flowing to the perform CBT courseware development function. *

USER_COM_User_Control_Commands = * Any control inputs to training from the users flowing to the perform combined training function. *

USER_CONT_User_Control_Commands = * Any control inputs to training from the users flowing to the perform consolidated training function. *

USER_DEST_User_Control_Commands = * Any control inputs to operation evaluation from the users flowing to the demonstrate/evaluate SS technology function. *

USER_DEV_User_Inputs = USER_PSF_User_Inputs+USER_PSD_User_Inputs+USER_PSI_User_Inputs * Any information from the users who include instructors, developers, and operators flowing to the perform development function. *

USER_DS_User_Control_Commands = * Any control inputs to development from the users flowing to the design simulator function. *

USER_FIS_User_Inputs = * Any information from the users who include instructors, developers, and operators flowing to the final integration of simulators function. *

USER_IES_User_Inputs = * Any information from the users who include instructors, developers, and operators flowing to the integrate



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external simulators function. *
USER_IPS_User_Inputs = * Any information from the users who include instructors, developers, and operators flowing to the integrate PTC simulators function. *
USER_IS_User_Control_Commands = * Any control inputs to development from the users flowing to the implement simulator function. *
USER_OPEV_Operations_Procedures = USER_SCP_Operations_Procedures+USER_SOCP_Operations_Procedures+USER_STV_Operations_Procedures * Operations procedures from the users to be utilized by the perform operations evaluation function. *
USER_OPEV_User_Control_Commands = USER_DEST_User_Control_Commands+USER_SCP_User_Control_Commands+USER_SOCP_User_Control_Commands+USER_SOCD_User_Control_Commands+USER_STV_User_Control_Commands * Any control inputs from the users to ops eval. *
USER_PCM_User_Control_Commands = * Any control inputs to development from the users flowing to the perform configuration management function. *
USER_PM_User_Control_Commands = * Any control inputs to development from the users flowing to the perform maintenance function. *
USER_PPCT_User_Control_Commands = USER_CONT_User_Control_Commands+USER_COM_User_Control_Commands+USER_PTT_User_Control_Commands * Any control inputs to the perform payload crew training function from the users. *
USER_PPI_User_Control_Commands = * Any control inputs to the POIC interface function to provide the capability to control the routing configuration. *
USER_PPOT_User_Control_Commands = USER_WORK_User_Control_Commands+USER_PPI_User_Control_Commands * Any control inputs to the perform POIC cadre training function from the users. *
USER_PPPT_User_Control_Commands = * Any control inputs to the perform PTC personnel training function from the users. *
USER_PSD_User_Inputs = USER_DS_User_Control_Commands+USER_IS_User_Control_Commands+USER_PCM_User_Control_Commands+USER_PM_User_Control_Commands+USER_PSRA_Training_Requirements+USER_PSRA_User_Control_Commands+USER_TS_User_Control_Commands * Any input from user. *
USER_PSF_User_Inputs = USER_CCD_User_Inputs+USER_PS_User_Control_Commands+USER_PTP_Training_Requirements+USER_PTP_User_Control_Commands+USER_PTRA_Analysis_Criteria * Any input from the user to the support func. *
USER_PSI_User_Inputs = USER_IPS_User_Inputs+USER_IES_User_Inputs+USER_FIS_User_Inputs * Any information from the users who include instructors, developers, and operators flowing to the perform simulator integration function. *
USER_PSRA_Training_Requirements = * Any training requirements developed by the users to be utilized by the perform simulator requirements



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analysis function. *

USER_PSRA_User_Control_Commands = * Any control inputs to development from the users flowing to the perform simulator requirements analysis function. *

USER_PS_User_Control_Commands = * Any control inputs to development from the users flowing to the perform setup function. *

USER_PTP_Training_Requirements = * Any training requirements developed by the users to be utilized by the perform training planning function. *

USER_PTP_User_Control_Commands = * Any control inputs to development from the users flowing to the perform training planning function. *

USER_PTRA_Analysis_Criteria = * Any information necessary to analyze training results from the users who include instructors, developers, and operators flowing to the perform training results analysis function. *

USER_PTT_User_Control_Commands = * Any control inputs to training from the users flowing to the perform part-task training function. *

USER_SCP_Operations_Procedures = * Operations procedures from the users to be utilized by the support crew procedures dev/test function. *

USER_SCP_User_Control_Commands = * Any control inputs to operations evaluation from the users flowing to the support crew procedures dev/test function. *

USER_SCS_User_Inputs = USER_TRA_User_Control_Commands+USER_DEV_User_Inputs+USER_OPEV_Operations_Procedures+USER_OPEV_User_Control_Commands * Any information from the users who include instructors, developers, operators, flowing to the SCS. *

USER_SOCD_User_Control_Commands = * Any control inputs to operations evaluation from the users flowing to the support operations concept definition function. *

USER_SOCP_Operations_Procedures = * Operations procedures from the users to be utilized by the support operations centers procedures dev/test function. *

USER_SOCP_User_Control_Commands = * Any control inputs to operations evaluation from the users flowing to the support operations centers procedures dev/test function. *

USER_STV_Operations_Procedures = * Operations procedures from the users to be utilized by the support timeline validation function. *

USER_STV_User_Control_Commands = * Any control inputs to operations evaluation from the users flowing to the support timeline validation function. *

USER_TRA_User_Control_Commands = USER_PPCT_User_Control_Commands+USER_PPOT_User_Control_Commands+USER_PPPT_User_Control_Commands * Any control inputs to training from the users flowing to the perform training

function. *

USER_TS_User_Control_Commands = * Any control inputs to development from the users flowing to the test simulator function. *

USER_WORK_User_Control_Commands = * Any control inputs to training from the users flowing to the support work-station training function. *

WORK_PPI_Payload_Data_Sets = * Any payload planning information such as short-term plan, target files, payload data files, etc., flowing to the provide POIC interface function. *

WORK_PPI_Uplink_Commands = * All uplink commands received from the work-station training flowing into the provide POIC interface function. *

WORK_SRR_Student_Records/Results = * All student records and training results gathered from any one or more training sessions during POIC cadre workstation training. *

WORK_USER_Responses_To_User = * Responses from the perform work-station training function to the users who include the instructors, developers, and operators. *



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Data Stores:

CW-Courseware = * The actual courseware to be utilized during computer based training. *
DI-Design_Info = * Simulator design information and test plans. *
PTR-PTC_Training_Results = * All training results gathered from training sessions of PTC personnel. This data is not required to go to TMIS. *
SDS-SCS_Developed_Sim = * Any payload simulators developed using the SCS. *
SIML-Simulations = * All payload simulators, subsystem simulators, and related information required for operation of the SCS. *
SR-Simulator_Req = * Simulator requirements information such as data base requirements and documents. *
SRR-Student_Records/Results = * All student records and training results gathered from any one or more training sessions. *
TD-Test_Documentation = * The culmination of all data needed to perform testing and validation for a simulator and also testing results. *
TP-Training_Plans = * Training plans that are a basis for training configuration operation. *
TRP-Tools_Rules_Procedures = * All tools, rules, and procedures provided by the SSE to develop and maintain software. *
TSET-Training_Setup_Info = * Any information needed for initialization for the trainer such as training configuration and scenarios. *

Processes:

CBT-Computer_Based_Training = * Performs all computer based training functions for the student to practice scenarios without intervention for the payload crew, POIC cadre, and PTC personnel. *

CBT_Perform_Computer_Based_Training = * Performs all computer based training functions for the student to practice various scenarios without instructor intervention for payload crew training. *

CCD-Perform_CBT_Courseware_Develop = * Performs all functions related to the development of training courseware to be utilized during computer based training. *

COM-Combined_Training = * Encompasses all functions necessary to provide training for an entire module such as the U.S. Lab, ESA, or JEM. *

CONT-Consolidate_Training = * Performs full consolidated training functions for all experiments for a specific payload increment. *

DEST-Demonstrate/Evaluate_SS_Tech = * Performs all functions relating to demonstrating or evaluating any candidate technologies for insertion into Space Station. *

DEV-Perform_Develop_Functions = * Encompasses all functions related to developing any software/hardware needed for simulated training functions including offline functions such as analyses and courseware development. *

DS-Design_Simulator = * Performs all functions relating to the actual design of a simulator such as producing software design information and hardware drawings for the actual implementation. *

FIS-Perform_Final_Integration_of_Sim = * Performs all functions of final integration of the SCS developed simulators and the simulators developed by external entities such as PIs into the operational PTC. *

IES-Integrate_External_Simulators = * Provides the capability of integration testing of externally developed simulators. *

INTR-SSTF_Integrated_Training = * Performs all functions necessary to have an integrated training capability with the SSTF. *

IPS-Integrate_PTC_Simulators = * Performs the function of integration testing of SCS developed simulators. *

IS-Implement_Simulator = * Performs the actual function of implementing the simulator. *

OPEV-Perform_Ops_Eval_Functions = * Performs all operation evaluation functions such as operations concepts definition, crew procedures development/testing, operations centers procedures development/testing, timeline validation, and demonstration of SS tech. *

PCM-Perform_Config_Management = * Performs all functions needed for

configuration management control of PTC hardware and software. *

PM-Perform_Maintenance = * Performs all maintenance functions relating to SCS simulators and facility software. *

PPCT-Perform_Payload_Crew_Training = * Encompasses all functions needed to perform payload crew training in normal and contingency payload operations. *

PPI-Provide_POIC_Interface = * Provides all capabilities necessary to interface with the POIC. *

PPOT-Perform_POIC_Cadre_Training = * Encompasses all functions necessary to train POIC ground operations personnel. *

PPPT-Perform_PTC_Personnel_Training = * Encompasses all functions necessary to train all PTC personnel. *

PS-Perform_Setup = * Encompasses all functions necessary to perform setup for training such as training configurations and training scenarios. *

PSD-Perform_Simulator_Development = * Encompasses all functions necessary to develop the simulator. *

PSF-Perform_Support_Functions = * Performs all support functions such as training planning, setup and configuration, CBT courseware development and training results anaylsis. *

PSI-Perform_Simulator_Integration = * Provides the capability for simulation integration testing. *

PSRA-Perform_Simulator_Req_Analysis = * Encompasses all functions necessary to develop simulator requirements. *

PTP-Perform_Training_Planning = * Provides the capability to capture training requirements and to produce detailed training plans and analyses that are a basis for training configuration operation. *

PTRA-Perform_Train_Results_Analysis = * Encompasses all functions necessary to analyze the training results through comparison with expected student responses. *

PTT-Part-Task_Training = * Encompasses all functions necessary to provide training for a certain subset of a payload increment. *

SCP-Support_Crew_Proc_Dev/Test = * Encompasses all functions necessary to support crew operations procedures development and testing. *

SCS-Simulation_Computer_System = * The computer hardware, software, and workstations that will support the Payload Training Complex (PTC). *

SOCD-Support_Ops_Concepts_Definition = * Encompasses all functions necessary to support prototyping, developing, and evaluating payload operational concepts. *

SOCP-Support_Op_Center_Proc_Dev/Test = * Encompasses all functions necessary to support the operations centers such as POIC, UOFs, DOCs, and ROCs procedure development and testing. *

STV-Support_Timeline_Verification = * Encompasses all functions necessary

to support timeline verification. *

TRA-Perform_Training_Functions = * All functions necessary to perform all SCS training which includes payload crew training, POIC cadre training, and PTC personnel training. *

TS-Test_Simulator = * Encompasses all functions necessary in order to completely test a simulator. *

WORK-Support_Work-Station_Training = * Encompasses all functions necessary to support POIC ground operations personnel training via POIC console work-station simulators internal to the POIC. *

Terminators:

MPS-Mission_Planning_System = * Provides the sum total of activities necessary to most efficiently utilize the resources of payload missions such as timeline generation, orbital mechanics, and orientation. *
PD-Payload_Developers = * Any external developer of payload simulators such as PIs. *
PFE-PTC_Facility_Equipment = * Any facility equipment in the PTC other than training devices such as facility audio/video and ground support equipment. *
POIC-POIC = * The Payload Operations Integration Center. *
PTD-PTC_Training_Devices = * All PTC elements that interact with the students such as crew workstations and control and display panels. *
SSE-SSE_System = * The Software Support Environment which contains all tools, rules, and procedures for developing and maintaining software for Space Station. *
SSTF-SSTF = * The Space Station Training Facility located at JSC. *
TMIS-TMIS = * The Technical Management Information System. *
USER-SCS_Users = * All users of the SCS who include instructors, developers, and operators. *

requirements to be met for a simulator flowing to the final integration of simulators function. *

PSD_IES_Test_Plans = * A general plan of what procedures and documentation are necessary to test a simulator flowing to the integrate external simulators function. *

PSD_IES_Test_Pro_&_Req = * The actual procedures for testing and requirements to be met for a simulator flowing to the integrate external simulators function. *

PSD_IPS_SCS_Developed_Sim = * Any payload simulators developed using the SCS flowing to the integrate PTC simulators function. *

PSD_IPS_Test_Plans = * A general plan of what procedures and documentation are necessary to test a simulator flowing to the integrate PTC simulators function. *

PSD_IPS_Test_Pro_&_Req = * The actual procedures for testing and requirements to be met for a simulator flowing to the integrate PTC simulators function. *

PSD_PSI_SCS_Developed_Sim = PSD_IPS_SCS_Developed_Sim+TS_PSI_SCS_Developed_Sim * Any payload simulators developed using the SCS flowing to the perform simulator integration function. *

PSD_PSI_Test_Documentation = TD_PSI_Test_Documentation+PSD_IPS_Test_Pro_&_Req+PSD_IPS_Test_Plans+PSD_IES_Test_Pro_&_Req+PSD_IES_Test_Plans+PSD_FIS_Test_Pro_&_Req+PSD_FIS_Test_Plans * The culmination of all data needed to perform testing and validation for a sim. *

PSD_SIML_Updated_Simulators = PM_SIML_Updated_Simulators * Simulators that have undergone some sort of changes through the maintenance function and are now flowing from the perform simulator dev function to the sim library. *

PSD_SSE_Simulations = TS_SSE_Simulations * Simulators that are going to the SSE from the perform simulator development function. *

PSD_SSE_Status_Info = PCM_SSE_Status_Info * Any information needed by the SSE such as configuration management information flowing from the perform simulator development function. *

PSD_USER_Responses_To_User = DS_USER_Responses_To_User+IS_USER_Responses_To_User+PCM_USER_Responses_To_User+PM_USER_Responses_To_User+PSRA_USER_Responses_To_User+TS_USER_Responses_To_User * Responses from the perform sim development function to the users. *

PSF_CW_Courseware = CCD_CW_Courseware * The actual courseware to be utilized during computer based training flowing from the perform CBT courseware development function. *

PSF_MPS_Service_Requests = PTP_MPS_Service_Requests * Any requests of data from the Mission Planning System from the perform support function. *

PSF_TMIS_Training_Results_Analysis = PTRA_TMIS_Training_Results_Analysis *

All training results analyses flowing to TMIS from the perform support function. *

PSF_TP_Training_Plans = PTP_TP_Training_Plans * Training plans that are a basis for training configuration operation flowing to the training planning data store. These do not include the schedules for training. *

PSF_TSET_Training_Config = PS_TSET_Training_Config * Information needed to setup for a particular training configuration flowing from the perform support function. *

PSF_TSET_Training_Scenario = PTP_TSET_Training_Scenario * A particular training scenario to be run for a specific training session from the perform support function. *

PSF_TSET_Training_Script = PS_TSET_Training_Script * A particular training script to be run for a specific training session from perform support functions. *

PSF_USER_Responses_To_User = CCD_USER_Responses_To_User+PS_USER_Responses_To_User+PTP_USER_Responses_To_User+PTRA_USER_Responses_To_User * Responses from the courseware development perform support function to the users. *

PSI_PSD_Test_Results = PSI_TD_Test_Results+IPS_PSD_Test_Results+IES_PSD_Test_Results+FIS_PSD_Test_Results * The results of the testing of a simulator in report form flowing from the perform simulator integration function. *

PSI_SIML_Simulations = FIS_SIML_Simulations * Simulators after integration flowing to the simulation library. *

PSI_TD_Test_Results = * The results of the testing of a simulator in report form flowing to the test documentation store. *

PSI_USER_Responses_To_User = FIS_USER_Responses_To_User+IPS_USER_Responses_To_User+IES_USER_Responses_To_User * Responses from the perform simulator integration function to the users who include the instructors, developers, and operators. *

PSRA_SR_Simulator_Req = * Simulator requirements information. *

PSRA_TD_Test_Plans = * A general plan of what procedures and documentation are necessary to test a simulator flowing from the perform simulator requirements analysis. *

PSRA_USER_Responses_To_User = * Responses from the perform simulator requirements analysis function to the users who include the instructors, developers, and operators. This data includes a simulator requirements analysis report. *

PS_TSET_Training_Config = * Information needed to setup for a particular training configuration flowing from the perform setup function. *

PS_TSET_Training_Script = * A particular training script to be run for a specific training session from the perform setup function. *

Data Flows:

PS_USER_Responses_To_User = * Responses from the perform setup function to the users who include the instructors, developers, and operators. *

PTD_CBT_Student_Inputs = * Any inputs from the student flowing to the perform computer based training function. *

PTD_COM_Student_Inputs = * Any inputs from the student flowing to the perform combined training function. *

PTD_CONT_Student_Inputs = * Any inputs from the student flowing to the perform consolidated training function. *

PTD_DEST_Student_Inputs = * Any inputs from the student flowing to the demonstrate/evaluate SS technology function. *

PTD_OPEV_Student_Inputs = PTD_DEST_Student_Inputs+PTD_SCP_Student_Inputs+PTD_SOCP_Student_Inputs+PTD_SOCD_Student_Inputs+PTD_STV_Student_Inputs * Any inputs from the student flowing to the perform operations evaluation function. *

PTD_PPCT_Student_Inputs = PTD_CONT_Student_Inputs+PTD_PTT_Student_Inputs+PTD_COM_Student_Inputs * Any inputs from the student flowing to the perform payload crew training function. *

PTD_PPPT_Student_Inputs = * Any inputs from the student flowing to the perform PTC personnel training function. *

PTD_PTT_Student_Inputs = * Any inputs from the student flowing to the perform part-task training function. *

PTD_SCP_Student_Inputs = * Any inputs from the student flowing to the support crew procedures dev/test function. *

PTD_SCS_Student_Inputs = PTD_OPEV_Student_Inputs+PTD_TRA_Student_Inputs * Any inputs from the student flowing to the SCS. *

PTD_SOCD_Student_Inputs = * Any inputs from the student flowing to the support operations concept definition function. *

PTD_SOCP_Student_Inputs = * Any inputs from the student flowing to the support operations centers procedures dev/test function. *

PTD_STV_Student_Inputs = * Any inputs from the student flowing to the support timeline validation function. *

PTD_TRA_Student_Inputs = PTD_CBT_Student_Inputs+PTD_PPCT_Student_Inputs+PTD_PPPT_Student_Inputs * Any inputs from the student flowing to the perform training function. *

PTP_MPS_Service_Requests = * Any requests of data from the Mission Planning System from the perform training planning function. *

PTP_TP_Training_Plans = * Training plans that are a basis for training configuration operation flowing to the training plans store. *

PTP_TSET_Training_Scenario = * A particular training scenario to be run

for a specific training session from the perform training planning function. *

PTP_USER_Responses_To_User = * Responses from the perform training planning function to the users who include the instructors, developers, and operators. This data contains the schedules for training. *

PTRA_TMIS_Training_Results_Analysis = * All training results analyses flowing to TMIS. This data only consists of payload crew and POIC cadre training results. PTC personnel results do not go to TMIS. *

PTRA_USER_Responses_To_User = * Responses from the perform training results analysis to the users who include the instructors, developers, and operators. This data contains the training results analysis for PTC personnel. *

PTT_PFE_Device_Commands = * Any command necessary to control the PTC facility equipment flowing from the perform part-task training function. *

PTT_PPOT_Downlink_Data = * The downlink data transmitted to the POIC from the perform part-task training function. *

PTT_PTD_Simulation_Outputs = * Responses generated by simulators during training sessions from the perform part-task training function. *

PTT_SRR_Student_Records/Results = * All student records and training results gathered from any one or more training sessions during payload crew part-task training. *

PTT_USER_Responses_To_User = * Responses from the perform part-task training function to the users who include the instructors, developers, and operators. *

SCP_MPS_Service_Requests = * Any requests of data from the Mission Planning System from the support crew procedures dev/test function. *

SCP_PFE_Device_Commands = * Any command necessary to control the PTC facility equipment flowing from the support crew procedures dev/test function. *

SCP_PTD_Simulation_Outputs = * Responses operated by simulators during training sessions from the support crew procedures dev/test function. *

SCP_USER_Responses_To_User = * Responses from the support crew procedures dev/test function to the users who include the instructors, developers, and operators. *

SCS_MPS_Service_Requests = DEV_MPS_Service_Requests+OPEV_MPS_Service_Requests * Any requests of data from the Mission Planning System from the SCS. *

SCS_PFE_Device_Commands = OPEV_PFE_Device_Commands+TRA_PFE_Device_Commands * Any command necessary to control the PTC facility equipment flowing from the SCS. *

SCS_POIC_Downlink_Data = OPEV_POIC_Downlink_Data+TRA_POIC_Downlink_Data *

The downlink data transmitted to the POIC from the SCS. *
SCS_PTD_Simulation_Outputs = OPEV_PTD_Simulation_Outputs+TRA_PTD_Simulation_Outputs * Responses generated by simulators during training sessions from the SCS. *
SCS_SSE_Simulations = DEV_SSE_Simulations * Payload simulators from the SCS flowing to the SSE. *
SCS_SSE_Status_Info = DEV_SSE_Status_Info * Any information needed by the SSE such as configuration management information flowing from the SCS. *
SCS_SSTF_C_&_D_Panel_Info = TRA_SSTF_C_&_D_Panel_Info * Any feedback from control and display panels from the SCS to the SSTF. *
SCS_SSTF_Simulated_Payload_Data = TRA_SSTF_Simulated_Payload_Data * Simulated payload data that emits from the SCS to the SSTF. *
SCS_SSTF_Sim_Command_Responses = TRA_SSTF_Sim_Command_Responses * Any responses to simulation control commands generated during an integrated training session with the SSTF flowing from the SCS. *
SCS_TMIS_Student_Records/Results = DEV_TMIS_Student_Records/Results * All student records and training results gathered from any one or more training sessions flowing from the SCS to TMIS. *
SCS_USER_Responses_To_User = DEV_USER_Responses_To_User+OPEV_USER_Responses_To_User+TRA_USER_Responses_To_User * Responses from the SCS to the users who include the instructors, developers, and operators. *
SDS_PCM_SCS_Developed_Sim = * Any payload simulators developed using the SCS flowing to the perform configuration management function. *
SDS_TS_SCS_Developed_Sim = * Any payload simulators developed using the SCS flowing to the test simulator function. *
SIML_CCD_Simulation_Config = * The simulation configuration needed for a specific training session flowing to the perform CBT courseware development function. *
SIML_COM_Simulations = * Payload simulations flowing to the perform combined training function. *
SIML_CONT_Simulations = * Payload simulations flowing to the perform consolidated training function. *
SIML_DEST_Simulations = * Payload simulations flowing to the demonstrate/evaluate SS technology function. *
SIML_DEV_Simulations = SIML_PSD_Simulations+SIML_PSF_Simulation_Config * Payload simulations to be utilized for testing by the perform development function. *
SIML_INTR_Simulations = * Payload simulations flowing to the perform integrated training function. *
SIML_OPEV_Simulations = SIML_DEST_Simulations+SIML_SCP_Simulations+SIML_SOCP_Simulations+SIML_SOCD_Simulations+SIML_STV_Simulations * Payload simulations needed to perform operations evaluation functions. *



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Data Flows:

SIML_PM_Operational_Sim = * All simulators that have been tested and are now operational in the PTC. *

SIML_PPCT_Simulations = SIML_CONT_Simulations+SIML_INTR_Simulations+SIML_PTT_Simulations+SIML_COM_Simulations * All simulations needed for the perform payload crew training function. *

SIML_PPOT_Simulations = SIML_WORK_Simulations * All simulations needed for the perform POIC cadre training function. *

SIML_PSD_Simulations = SIML_PM_Operational_Sim * All simulations needed for the perform simulator development function. *

SIML_PSF_Simulation_Config = SIML_CCD_Simulation_Config+SIML_PS_Simulation_Config * The simulation configuration needed for a specific training session flowing to the perform support function. *

SIML_PS_Simulation_Config = * The simulation configuration needed for a specific training session flowing to the perform setup function. *

SIML_PTT_Simulations = * Payload simulations flowing to the perform part-task training function. *

SIML_SCP_Simulations = * Payload simulations flowing to the support crew procedures dev/test function. *

SIML_SOCD_Simulations = * Payload simulations flowing to the support operations concept definition function. *

SIML_SOCP_Simulations = * Payload simulations flowing to the support operations centers procedures dev/test function. *

SIML_STV_Simulations = * Payload simulations flowing to the support timeline validation function. *

SIML_TRA_Simulations = SIML_PPCT_Simulations+SIML_PPOT_Simulations * Simulations needed by the perform training function. *

SIML_WORK_Simulations = * Payload simulations flowing to the support work-station training function. *

SOCD_MPS_Service_Requests = * Any requests of data from the Mission Planning System from the support operations concept definition function. *

SOCD_PFE_Device_Commands = * Any command necessary to control the PTC facility equipment flowing from the support operations concepts definitions function. *

SOCD_PTD_Simulation_Outputs = * Responses generated by simulators during training sessions from the support operations concept definition function. *

SOCD_USER_Responses_To_User = * Responses from the operations concepts definition function to the users who include the instructors,

developers, and operators. *

SOCP_MPS_Service_Requests = * Any requests of data from the Mission Planning System from the support operations centers procedures dev/test function. *

SOCP_PFE_Device_Commands = * Any command necessary to control the PTC facility equipment flowing from the support operations centers procedures dev/test function. *

SOCP_POIC_Downlink_Data = * The downlink data transmitted to the POIC from the support operations centers procedures dev/test function. *

SOCP_PTD_Simulation_Outputs = * Responses generated by simulators during training sessions from the support operations centers procedures dev/test function. *

SOCP_USER_Responses_To_User = * Responses from the support operations centers procedures dev/test function to the users who include the instructors, developers, and operators. *

SRR_DEV_Student_Records/Results = SRR_PSF_Student_Records/Results * All student records and training results gathered from any one or more training sessions flowing to the perform development function. *

SRR_PSF_Student_Records/Results = SRR_PTRA_Student_Records/Results * All student records and training results gathered from any one or more training sessions flowing to the perform support function. *

SRR_PTRA_Student_Records/Results = * All student records and training results gathered from any one or more training sessions in order to be analyzed for training results. *

SR_DS_Simulator_Req = * Simulator requirements information such as data base requirements and documents flowing to the design simulator function. *

SR_PCM_Simulator_Req = * Simulator requirements information such as data base requirements and documents flowing to the perform configuration management function. *

SR_TS_Simulator_Req = * Simulator requirements information such as data base requirements and documents flowing to the test simulator function. *

SSE_DEV_Flight_Software = SSE_PSD_Flight_Software+SSE_PSI_Flight_Software * The flight software flowing to the perform development function. *

SSE_DEV_Status_Info = SSE_PSD_Status_Info * Any information needed by the SCS such as configuration management information flowing from the SSE. *

SSE_DEV_System_Simulations = SSE_PSI_System_Simulations * All system simulations from the SSE required to support the payload simulators flowing to the perform development function. *

SSE_FIS_Flight_Software = * The flight software flowing to the final integration of simulators function. *



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SSE_IES_Flight_Software = * The flight software flowing to the integrate external simulators function. *

SSE_IES_System_Simulations = * All system simulations from the SSE required to support the payload simulators for training flowing to the integrate external simulators function. *

SSE_IPS_Flight_Software = * The flight software flowing to the integrate PTC simulators function. *

SSE_PCM_CM_Info = * Any configuration management information needed from the SSE flowing to the perform configuration management function. *

SSE_PSD_Flight_Software = SSE_TS_Flight_Software * The flight software flowing to the perform simulator development function. *

SSE_PSD_Status_Info = SSE_PCM_CM_Info * Any information needed by the SCS such as configuration management information flowing to the perform simulator development function. *

SSE_PSI_Flight_Software = SSE_FIS_Flight_Software+SSE_IPS_Flight_Software+SSE_IES_Flight_Software * The flight software flowing to the perform simulator integration function. *

SSE_PSI_System_Simulations = SSE_IES_System_Simulations * All system simulations from the SSE required to support the payload simulators flowing to the perform simulator integration function. *

SSE_SCS_Flight_Software = SSE_DEV_Flight_Software * The flight software flowing to the SCS. *

SSE_SCS_Status_Info = SSE_DEV_Status_Info * Any information needed by the SCS such as configuration management information flowing from the SSE. *

SSE_SCS_System_Simulations = SSE_DEV_System_Simulations * All system simulations from the SSE required to support the payload simulators flowing to the SCS. *

SSE_SCS_Tools_Rules_Procedures = SSE_TRP_Tools_Rules_Procedures * All tools, rules, and procedures provided by the SSE to develop and maintain software flowing to the SCS. *

SSE_TRP_Tools_Rules_Procedures = * All tools, rules, and procedures provided by the SSE to develop and maintain software flowing to the perform development function. *

SSE_TS_Flight_Software = * The flight software flowing to the test simulator function. *

SSTF_INTR_C_&_D_Panel_Info = * Any feedback from control and display panels from the SSTF to integrated training. *

SSTF_INTR_Simulation_Control_Commands = * All commands necessary to operate payload simulations during an integrated training session with the SSTF flowing to the integrated training function. *

SSTF_INTR_Subsystem_Simulation_Inputs = * Any data needed for subsystem simulation during an integrated training session with the SSTF flowing

to the integrated training function. *

SSTF_PPCT_C_&_D_Panel_Info = SSTF_INTR_C_&_D_Panel_Info * Any feedback from control and display panels from the SSTF flowing to the perform payload crew training function. *

SSTF_PPCT_Simulation_Control_Commands = SSTF_INTR_Simulation_Control_Commands * All commands necessary to operate payload simulations during an integrated training session with the SSTF flowing to the perform payload crew training function. *

SSTF_PPCT_Subsystem_Simulation_Inputs = SSTF_INTR_Subsystem_Simulation_Inputs * Any data needed for subsystem simulation during an integrated training session with the SSTF flowing to the perform payload crew training function. *

SSTF_SCS_C_&_D_Panel_Info = SSTF_TRA_C_&_D_Panel_Info * Any feedback from control and display panels from the SSTF to the SCS. *

SSTF_SCS_Simulation_Control_Commands = SSTF_TRA_Simulation_Control_Commands * All commands necessary to operate payload simulations during an integrated training session with the SSTF flowing to the SCS. *

SSTF_SCS_Subsystem_Simulation_Inputs = SSTF_TRA_Subsystem_Simulation_Inputs * Any data needed for subsystem simulation during an integrated training session with the SSTF flowing to the SCS. *

SSTF_TRA_C_&_D_Panel_Info = SSTF_PPCT_C_&_D_Panel_Info * Any feedback from control and display panels from the perform training function to the SSTF. *

SSTF_TRA_Simulation_Control_Commands = SSTF_PPCT_Simulation_Control_Commands * All commands necessary to operate payload simulations during an integrated training session with the SSTF flowing to the perform training function. *

SSTF_TRA_Subsystem_Simulation_Inputs = SSTF_PPCT_Subsystem_Simulation_Inputs * Any data needed for subsystem simulation during an integrated training session with the SSTF flowing to the perform training function. *

STV_MPS_Service_Requests = * Any requests of data from the Mission Planning System from the support timeline validation function. *

STV_PFE_Device_Commands = * Any command necessary to control the PTC facility equipment flowing from the support timeline validation function. *

STV_PTD_Simulation_Outputs = * Responses generated by simulators during training sessions from the support timeline validation function. *

STV_USER_Responses_To_User = * Responses from the support timeline validation function to the users who include the instructors, developers, and operators. *

TD_PCM_Test_Documentation = * The test documentation for an SCS developed



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payload simulator to be controlled under configuration management. *

TD_PSI_Test_Documentation = * The culmination of all data needed to perform testing and validation for a simulator and also testing results flowing to the perform simulator integration function. *

TD_TS_Test_Documentation = * The culmination of all data needed to perform testing and validation for a simulator and also all testing results flowing to the test simulator function. *

TMIS_DEV_Program_Schedules = TMIS_PSD_Program_Schedules * All information relating to the schedule for mission training flowing to the perform development function. *

TMIS_PCM_Program_Schedules = * All information relating to the schedule for mission training flowing to the perform configuration management function. *

TMIS_PSD_Program_Schedules = TMIS_PCM_Program_Schedules * All information relating to the schedule for mission training flowing to the perform simulator development function. *

TMIS_SCS_Program_Schedules = TMIS_DEV_Program_Schedules * All information relating to the schedule for mission training flowing to the SCS. *

TP_CCD_CBT_Courseware_Req = * CBT courseware requirements contain essential information necessary to build CBT courseware specific to a training session flowing from the training planning function. *

TP_PSD_Training_Plans = TP_PSRA_Training_Plans * Training plans that are a basis for training simulator requirements definition flowing to the perform simulator development function. These do not include the schedules for training. *

TP_PSF_Training_Plans = TP_PS_Training_Scenario+TP_PS_Training_Script_Req+TP_CCD_CBT_Courseware_Req * Training plans that are necessary to complete the setup and CBT courseware development functions such as training scenarios, script req, and courseware req. *

TP_PSRA_Training_Plans = * Training plans contain information essential to the building of simulator requirements such as training scenarios, script requirements, and any other documentation relative to training. *

TP_PS_Training_Scenario = * A particular training scenario to be run for a specific training session from the training planning data store. This scenario is to be utilized for script building. *

TP_PS_Training_Script_Req = * Script requirements contain necessary information to build and determine script functionality that flow from the training planning data store. *

TRA_PFE_Device_Commands = PPCT_PFE_Device_Commands * Any command necessary to control the PTC facility equipment flowing from the perform training function. *

TRA_POIC_Downlink_Data = PPOT_POIC_Downlink_Data * The downlink data



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transmitted to the POIC from the perform training function. *

TRA_PTD_Simulation_Outputs = CBT_PTD_Courseware_Responses+PPCT_PTD_Simulation_Outputs+PPPT_PTD_Simulation_Outputs * Responses generated by simulators during training sessions from the perform training function. *

TRA_SRR_Student_Records/Results = CBT_SRR_Student_Records/Results+PPCT_SRR_Student_Records/Results+PPOT_SRR_Student_Records/Results * All student records and training results gathered from any one or more training sessions flowing from the perform training function. *

TRA_SSTF_C_&_D_Panel_Info = PPCT_SSTF_C_&_D_Panel_Info * Any feedback from control and display panels from the perform training function to the SSTF. *

TRA_SSTF_Simulated_Payload_Data = PPCT_SSTF_Simulated_Payload_Data * Simulated payload data that emits from the perform training function to the SSTF. *

TRA_SSTF_Sim_Command_Responses = PPCT_SSTF_Sim_Command_Responses * Any responses to simulation control commands generated during an integrated training session with the SSTF flowing from the perform training function. *

TRA_USER_Responses_To_User = PPCT_USER_Responses_To_User+PPOT_USER_Responses_To_User+PPPT_USER_Responses_To_User * Responses from the perform training function to the users who include the instructors, developers, and operators. *

TRP_DEV_Tools_Rules_Procedures = TRP_PSD_Tools_Rules_Procedures+TRP_PSI_Tools_Rules_Procedures * All tools, rules, and procedures provided by the SSE to develop and maintain software flowing to the perform simulator development function. *

TRP_DS_Design_Tools = * Any specific tools required from the SSE in order to design a simulator. *

TRP_FIS_Tools_Rules_Procedures = * All tools, rules, and procedures provided by the SSE to develop and maintain software flowing to the final integration of simulators function. *

TRP_IES_Tools_Rules_Procedures = * All tools, rules, and procedures provided by the SSE to develop and maintain software flowing to the integrate external simulators function. *

TRP_IPS_Tools_Rules_Procedures = * All tools, rules, and procedures provided by the SSE to develop and maintain software flowing to the integrate PTC simulators function. *

TRP_IS_Imp_Tools = * Any specific tools required from the SSE in order to implement a simulator. *

TRP_IS_Reusable_Products = * Any reusable products from the SSE that will support implementation of a simulator. *



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TRP_PCM_CM_Tools = * Any specific tools required from the SSE in order to perform configuration management. *

TRP_PM_Tools_Rules_Procedures = * All tools, rules, and procedures provided by the SSE to develop and maintain software flowing to the perform maintenance function. *

TRP_PSD_Tools_Rules_Procedures = TRP_DS_Design_Tools+TRP_IS_Imp_Tools+TRP_PCM_CM_Tools+TRP_PM_Tools_Rules_Procedures+TRP_PSRA_Req_Tools+TRP_TS_Test_Tools+TRP_IS_Reusable_Products * All tools, rules, and procedures provided by the SSE to develop and maintain software. *

TRP_PSI_Tools_Rules_Procedures = TRP_FIS_Tools_Rules_Procedures+TRP_IPS_Tools_Rules_Procedures+TRP_IES_Tools_Rules_Procedures * All tools, rules, and procedures provided by the SSE to develop and maintain software flowing to sim integration. *

TRP_PSRA_Req_Tools = * Any specific tools required from the SSE in order to build requirements flowing to the perform simulator requirements analysis function. *

TRP_TS_Test_Tools = * Any specific tools required from the SSE in order to support simulator test development and execution. *

TSET_COM_Training_Config = * Information needed to setup for a particular training configuration flowing to the perform combined training function. *

TSET_COM_Training_Scenario = * A particular training scenario to be run for a specific training session flowing to the perform combined training function. *

TSET_CONT_Training_Config = * Information needed to setup for a particular training configuration flowing to the perform consolidated training function. *

TSET_CONT_Training_Scenario = * A particular training scenario to be run for a specific training session flowing to the perform consolidated training function. *

TSET_DEST_Training_Setup_Info = * Any information needed for initialization for the trainer such as training configuration and scenarios flowing to the demonstrate/evaluate SS technology function. *

TSET_DEV_Training_Scenario = TSET_PSF_Training_Scenario * Training scenario to be utilized for training results analysis to gather the expected results. *

TSET_OPEV_Training_Setup_Info = TSET_DEST_Training_Setup_Info+TSET_SCP_Training_Setup_Info+TSET_SOCP_Training_Setup_Info+TSET_SOCD_Training_Setup_Info+TSET_STV_Training_Setup_Info * Any information needed for initialization for the trainer. *

TSET_PPCT_Training_Config = TSET_PTT_Training_Config+TSET_COM_Training_Config+TSET_CONT_Training_Config * Information needed to setup for a



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particular training configuration flowing to the perform payload crew training function. *

TSET_PPCT_Training_Scenario = TSET_PTT_Training_Scenario+TSET_COM_Training_Scenario+TSET_CONT_Training_Scenario * A particular training scenario to be run for a specific training session flowing to the perform payload crew training function. *

TSET_PPI_Training_Config = * The training configuration that is necessary to setup the hardware configuration and communication protocol for the POIC interface function. *

TSET_PPOT_Training_Config = TSET_WORK_Training_Config+TSET_PPI_Training_Config * Information needed to setup for a particular training configuration flowing to the perform POIC cadre training function. *

TSET_PPOT_Training_Scenario = TSET_WORK_Training_Scenario * A particular training scenario to be run for a specific training session flowing to the perform POIC cadre training function. *

TSET_PPPT_Training_Config = * Information needed to setup for a particular training configuration flowing to the perform PTC personnel training function. *

TSET_PPPT_Training_Scenario = * A particular training scenario to be run for a specific training session flowing to the perform PTC personnel training function. *

TSET_PSF_Training_Scenario = TSET_PTRA_Training_Scenario * Training scenario to be utilized for expected results data for the perform results analysis function. *

TSET_PTRA_Training_Scenario = * Training scenario to be utilized to obtain expected results for training in order to perform a training results analysis. *

TSET_PTT_Training_Config = * Information needed to setup for a particular training configuration flowing to the perform part-task training function. *

TSET_PTT_Training_Scenario = * A particular training scenario to be run for a specific training session flowing to the perform part-task training function. *

TSET_SCP_Training_Setup_Info = * Any information needed for initialization for the trainer such as training configuration and scenarios flowing to the support crew procedures dev/test function. *

TSET_SOCD_Training_Setup_Info = * Any information needed for initialization for the trainer such as training configuration and scenarios flowing to the support operations concept definition function. *

TSET_SOCP_Training_Setup_Info = * Any information needed for initialization for the trainer such as training configuration and



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scenarios flowing to the support operations centers procedures dev/test function. *

TSET_STV_Training_Setup_Info = * Any information needed for initialization for the trainer such as training configuration and scenarios flowing to the support timeline validation function. *

TSET_TRA_Training_Setup_Info = TSET_PPCT_Training_Config+TSET_PPCT_Training_Scenario+TSET_PPOT_Training_Config+TSET_PPOT_Training_Scenario+TSET_PPPT_Training_Config+TSET_PPPT_Training_Scenario * Any information needed for training setup. *

TSET_WORK_Training_Config = * Information needed to setup for a particular training configuration flowing to the support work-station training function. *

TSET_WORK_Training_Scenario = * A particular training scenario to be run for a specific training session flowing to the support work-station training function. *

TS_PSI_SCS_Developed_Sim = * Any payload simulators developed using the SCS flowing from the test simulator function. *

TS_SSE_Simulations = * Payload simulations flowing to the SSE. *

TS_TD_Test_Results = * The results of the testing of a simulator in report form flowing from the test simulator function. *

TS_USER_Responses_To_User = * Responses from the test simulator function to the users who include the instructors, developers, and operators. *

USER_CBD_User_Inputs = * Any information from the users who include instructors, developers, and operators flowing to the perform CBT courseware development function. *

USER_COM_User_Control_Commands = * Any control inputs to training from the users flowing to the perform combined training function. *

USER_CONT_User_Control_Commands = * Any control inputs to training from the users flowing to the perform consolidated training function. *

USER_DEST_User_Control_Commands = * Any control inputs to operation evaluation from the users flowing to the demonstrate/evaluate SS technology function. *

USER_DEV_User_Inputs = USER_PSF_User_Inputs+USER_PSD_User_Inputs+USER_PSI_User_Inputs * Any information from the users who include instructors, developers, and operators flowing to the perform development function. *

USER_DS_User_Control_Commands = * Any control inputs to development from the users flowing to the design simulator function. *

USER_FIS_User_Inputs = * Any information from the users who include instructors, developers, and operators flowing to the final integration of simulators function. *

USER_IES_User_Inputs = * Any information from the users who include instructors, developers, and operators flowing to the integrate

external simulators function. *

USER_IPS_User_Inputs = * Any information from the users who include instructors, developers, and operators flowing to the integrate PTC simulators function. *

USER_IS_User_Control_Commands = * Any control inputs to development from the users flowing to the implement simulator function. *

USER_OPEV_Operations_Procedures = USER_SCP_Operations_Procedures+USER_SOCP_Operations_Procedures+USER_STV_Operations_Procedures * Operations procedures from the users to be utilized by the perform operations evaluation function. *

USER_OPEV_User_Control_Commands = USER_DEST_User_Control_Commands+USER_SCP_User_Control_Commands+USER_SOCP_User_Control_Commands+USER_SOCD_User_Control_Commands+USER_STV_User_Control_Commands * Any control inputs from the users to ops eval. *

USER_PCM_User_Control_Commands = * Any control inputs to development from the users flowing to the perform configuration management function. *

USER_PM_User_Control_Commands = * Any control inputs to development from the users flowing to the perform maintenance function. *

USER_PPCT_User_Control_Commands = USER_CONT_User_Control_Commands+USER_COM_User_Control_Commands+USER_PTT_User_Control_Commands * Any control inputs to the perform payload crew training function from the users. *

USER_PPI_User_Control_Commands = * Any control inputs to the POIC interface function to provide the capability to control the routing configuration. *

USER_PPOT_User_Control_Commands = USER_WORK_User_Control_Commands+USER_PPI_User_Control_Commands * Any control inputs to the perform POIC cadre training function from the users. *

USER_PPPT_User_Control_Commands = * Any control inputs to the perform PTC personnel training function from the users. *

USER_PSD_User_Inputs = USER_DS_User_Control_Commands+USER_IS_User_Control_Commands+USER_PCM_User_Control_Commands+USER_PM_User_Control_Commands+USER_PSRA_Training_Requirements+USER_PSRA_User_Control_Commands+USER_TS_User_Control_Commands * Any input from user. *

USER_PSF_User_Inputs = USER_CCD_User_Inputs+USER_PS_User_Control_Commands+USER_PTP_Training_Requirements+USER_PTP_User_Control_Commands+USER_PTRA_Analysis_Criteria * Any input from the user to the support func. *

USER_PSI_User_Inputs = USER_IPS_User_Inputs+USER_IES_User_Inputs+USER_FIS_User_Inputs * Any information from the users who include instructors, developers, and operators flowing to the perform simulator integration function. *

USER_PSRA_Training_Requirements = * Any training requirements developed by the users to be utilized by the perform simulator requirements

analysis function. *

USER_PSRA_User_Control_Commands = * Any control inputs to development from the users flowing to the perform simulator requirements analysis function. *

USER_PS_User_Control_Commands = * Any control inputs to development from the users flowing to the perform setup function. *

USER_PTP_Training_Requirements = * Any training requirements developed by the users to be utilized by the perform training planning function. *

USER_PTP_User_Control_Commands = * Any control inputs to development from the users flowing to the perform training planning function. *

USER_PTRA_Analysis_Criteria = * Any information necessary to analyze training results from the users who include instructors, developers, and operators flowing to the perform training results analysis function. *

USER_PTT_User_Control_Commands = * Any control inputs to training from the users flowing to the perform part-task training function. *

USER_SCP_Operations_Procedures = * Operations procedures from the users to be utilized by the support crew procedures dev/test function. *

USER_SCP_User_Control_Commands = * Any control inputs to operations evaluation from the users flowing to the support crew procedures dev/test function. *

USER_SCS_User_Inputs = USER_TRA_User_Control_Commands+USER_DEV_User_Inputs+USER_OPEV_Operations_Procedures+USER_OPEV_User_Control_Commands * Any information from the users who include instructors, developers, operators, flowing to the SCS. *

USER_SOCD_User_Control_Commands = * Any control inputs to operations evaluation from the users flowing to the support operations concept definition function. *

USER_SOCP_Operations_Procedures = * Operations procedures from the users to be utilized by the support operations centers procedures dev/test function. *

USER_SOCP_User_Control_Commands = * Any control inputs to operations evaluation from the users flowing to the support operations centers procedures dev/test function. *

USER_STV_Operations_Procedures = * Operations procedures from the users to be utilized by the support timeline validation function. *

USER_STV_User_Control_Commands = * Any control inputs to operations evaluation from the users flowing to the support timeline validation function. *

USER_TRA_User_Control_Commands = USER_PPCT_User_Control_Commands+USER_PPOT_User_Control_Commands+USER_PPPT_User_Control_Commands * Any control inputs to training from the users flowing to the perform training

function. *

USER_TS_User_Control_Commands = * Any control inputs to development from the users flowing to the test simulator function. *

USER_WORK_User_Control_Commands = * Any control inputs to training from the users flowing to the support work-station training function. *

WORK_PPI_Payload_Data_Sets = * Any payload planning information such as short-term plan, target files, payload data files, etc., flowing to the provide POIC interface function. *

WORK_PPI_Uplink_Commands = * All uplink commands received from the work-station training flowing into the provide POIC interface function. *

WORK_SRR_Student_Records/Results = * All student records and training results gathered from any one or more training sessions during POIC cadre workstation training. *

WORK_USER_Responses_To_User = * Responses from the perform work-station training function to the users who include the instructors, developers, and operators. *



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Data Stores:

CW-Courseware = * The actual courseware to be utilized during computer based training. *
DI-Design_Info = * Simulator design information and test plans. *
PTR-PTC_Training_Results = * All training results gathered from training sessions of PTC personnel. This data is not required to go to TMIS. *
SDS-SCS_Developed_Sim = * Any payload simulators developed using the SCS. *
SIML-Simulations = * All payload simulators, subsystem simulators, and related information required for operation of the SCS. *
SR-Simulator_Req = * Simulator requirements information such as data base requirements and documents. *
SRR-Student_Records/Results = * All student records and training results gathered from any one or more training sessions. *
TD-Test_Documentation = * The culmination of all data needed to perform testing and validation for a simulator and also testing results. *
TP-Training_Plans = * Training plans that are a basis for training configuration operation. *
TRP-Tools_Rules_Procedures = * All tools, rules, and procedures provided by the SSE to develop and maintain software. *
TSET-Training_Setup_Info = * Any information needed for initialization for the trainer such as training configuration and scenarios. *

Processes:

CBT-Computer_Based_Training = * Performs all computer based training functions for the student to practice scenarios without intervention for the payload crew, POIC cadre, and PTC personnel. *

CBT_Perform_Computer_Based_Training = * Performs all computer based training functions for the student to practice various scenarios without instructor intervention for payload crew training. *

CCD-Perform_CBT_Courseware_Develop = * Performs all functions related to the development of training courseware to be utilized during computer based training. *

COM-Combined_Training = * Encompasses all functions necessary to provide training for an entire module such as the U.S. Lab, ESA, or JEM. *

CONT-Consolidate_Training = * Performs full consolidated training functions for all experiments for a specific payload increment. *

DEST-Demonstrate/Evaluate_SS_Tech = * Performs all functions relating to demonstrating or evaluating any candidate technologies for insertion into Space Station. *

DEV-Perform_Develop_Functions = * Encompasses all functions related to developing any software/hardware needed for simulated training functions including offline functions such as analyses and courseware development. *

DS-Design_Simulator = * Performs all functions relating to the actual design of a simulator such as producing software design information and hardware drawings for the actual implementation. *

FIS-Perform_Final_Integration_of_Sim = * Performs all functions of final integration of the SCS developed simulators and the simulators developed by external entities such as PIs into the operational PTC. *

IES-Integrate_External_Simulators = * Provides the capability of integration testing of externally developed simulators. *

INTR-SSTF_Integrated_Training = * Performs all functions necessary to have an integrated training capability with the SSTF. *

IPS-Integrate_PTC_Simulators = * Performs the function of integration testing of SCS developed simulators. *

IS-Implement_Simulator = * Performs the actual function of implementing the simulator. *

OPEV-Perform_Ops_Eval_Functions = * Performs all operation evaluation functions such as operations concepts definition, crew procedures development/testing, operations centers procedures development/testing, timeline validation, and demonstration of SS tech. *

PCM-Perform_Config_Management = * Performs all functions needed for

configuration management control of PTC hardware and software. *

PM-Perform_Maintenance = * Performs all maintenance functions relating to SCS simulators and facility software. *

PPCT-Perform_Payload_Crew_Training = * Encompasses all functions needed to perform payload crew training in normal and contingency payload operations. *

PPI-Provide_POIC_Interface = * Provides all capabilities necessary to interface with the POIC. *

PPOT-Perform_POIC_Cadre_Training = * Encompasses all functions necessary to train POIC ground operations personnel. *

PPPT-Perform_PTC_Personnel_Training = * Encompasses all functions necessary to train all PTC personnel. *

PS-Perform_Setup = * Encompasses all functions necessary to perform setup for training such as training configurations and training scenarios. *

PSD-Perform_Simulator_Development = * Encompasses all functions necessary to develop the simulator. *

PSF-Perform_Support_Functions = * Performs all support functions such as training planning, setup and configuration, CBT courseware development and training results anaylsis. *

PSI-Perform_Simulator_Integration = * Provides the capability for simulation integration testing. *

PSRA-Perform_Simulator_Req_Analysis = * Encompasses all functions necessary to develop simulator requirements. *

PTP-Perform_Training_Planning = * Provides the capability to capture training requirements and to produce detailed training plans that are a basis for training configuration operation. *

PTRA-Perform_Train_Results_Analysis = * Encompasses all functions necessary to analyze the training results through comparison with expected student responses. *

PTT-Part-Task_Training = * Encompasses all functions necessary to provide training for a certain subset of a payload increment. *

SCP-Support_Crew_Proc_Dev/Test = * Encompasses all functions necessary to support crew operations procedures development and testing. *

SCS-Simulation_Computer_System = * The computer hardware, software, and workstations that will support the Payload Training Complex (PTC). *

SOCD-Support_Ops_Concepts_Definition = * Encompasses all functions necessary to support prototyping, developing, and evaluating payload operational concepts. *

SOCP-Support_Op_Center_Proc_Dev/Test = * Encompasses all functions necessary to support the operations centers such as POIC, UOFs, DOCs, and ROCs procedure development and testing. *

STV-Support_Timeline_Verification = * Encompasses all functions necessary

to support timeline verification. *

TRA-Perform_Training_Functions = * All functions necessary to perform all SCS training which includes payload crew training, POIC cadre training, and PTC personnel training. *

TS-Test_Simulator = * Encompasses all functions necessary in order to completely test a simulator. *

WORK-Support_Work-Station_Training = * Encompasses all functions necessary to support POIC ground operations personnel training via POIC console work-station simulators internal to the POIC. *

Terminators:

MPS-Mission_Planning_System = * Provides the sum total of activities necessary to most efficiently utilize the resources of payload missions such as timeline generation, orbital mechanics, and orientation. *
PD-Payload_Developers = * Any external developer of payload simulators such as PIs. *
PFE-PTC_Facility_Equipment = * Any facility equipment in the PTC other than training devices such as facility audio/video and ground support equipment. *
POIC-POIC = * The Payload Operations Integration Center. *
PTD-PTC_Training_Devices = * All PTC elements that interact with the students such as crew workstations and control and display panels. *
SSE-SSE_System = * The Software Support Environment which contains all tools, rules, and procedures for developing and maintaining software for Space Station. *
SSTF-SSTF = * The Space Station Training Facility located at JSC. *
TMIS-TMIS = * The Technical Management Information System. *
USER-SCS_Users = * All users of the SCS who include instructors, developers, and operators. *